IN MEMORIUM: John Field

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2010 U.S. Army Corrosion Summit
February 9-11, 2010

DEMONSTRATION OF A RETROFIT CORROSION-RESISTANT FIRE HYDRANT WHICH ALSO PROTECTS AGAINST DELIBERATE CONTAMINATION OF CRITICAL ARMY WATER SUPPLIES

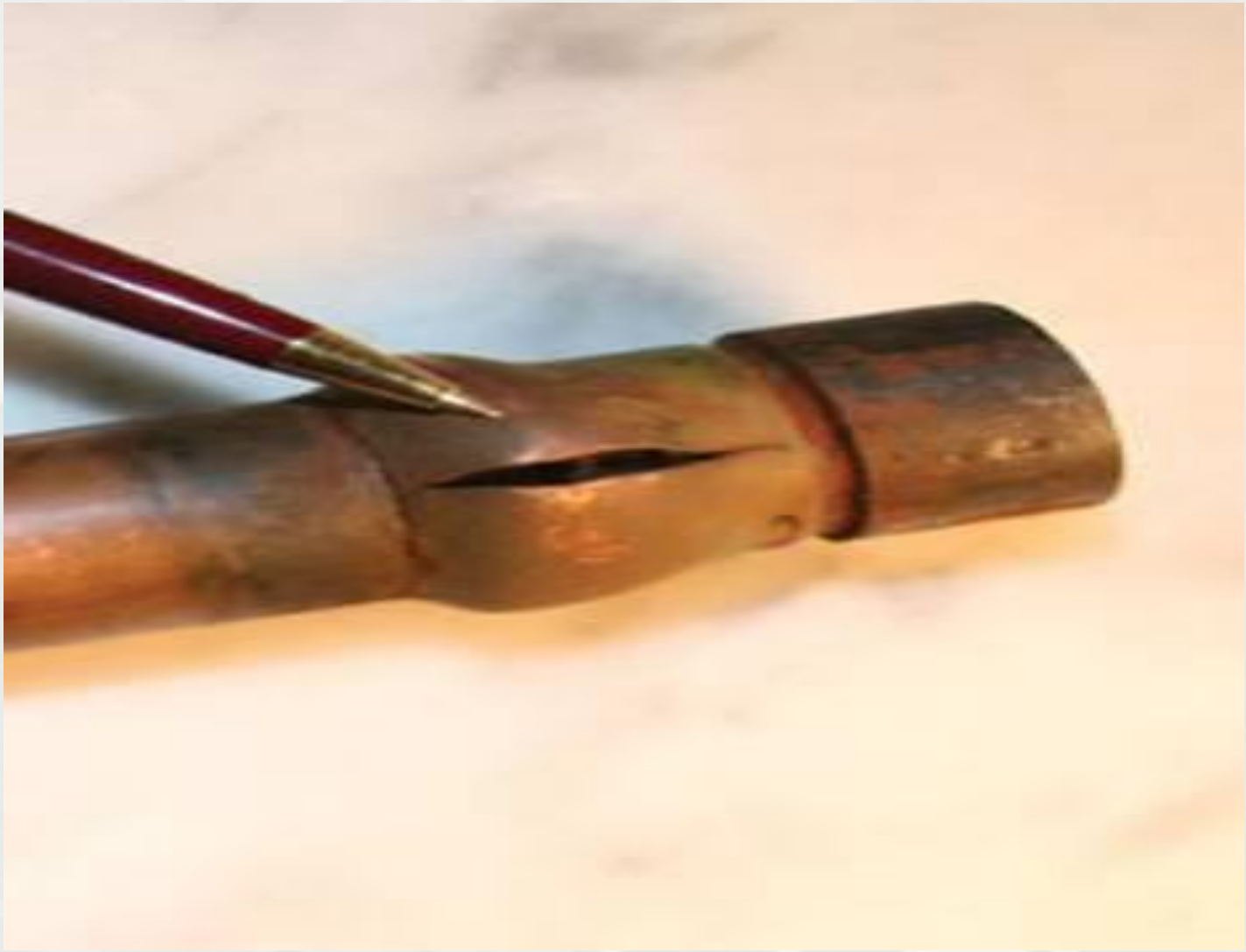
Vincent F. Hock, Vicki Van Blaricum, Mark Ginsberg, Susan A. Drozdz and Eddy Dean Smith, Ph.D., DEE

Engineer Research and Development Center
Construction Engineering Research Lab
Champaign, IL

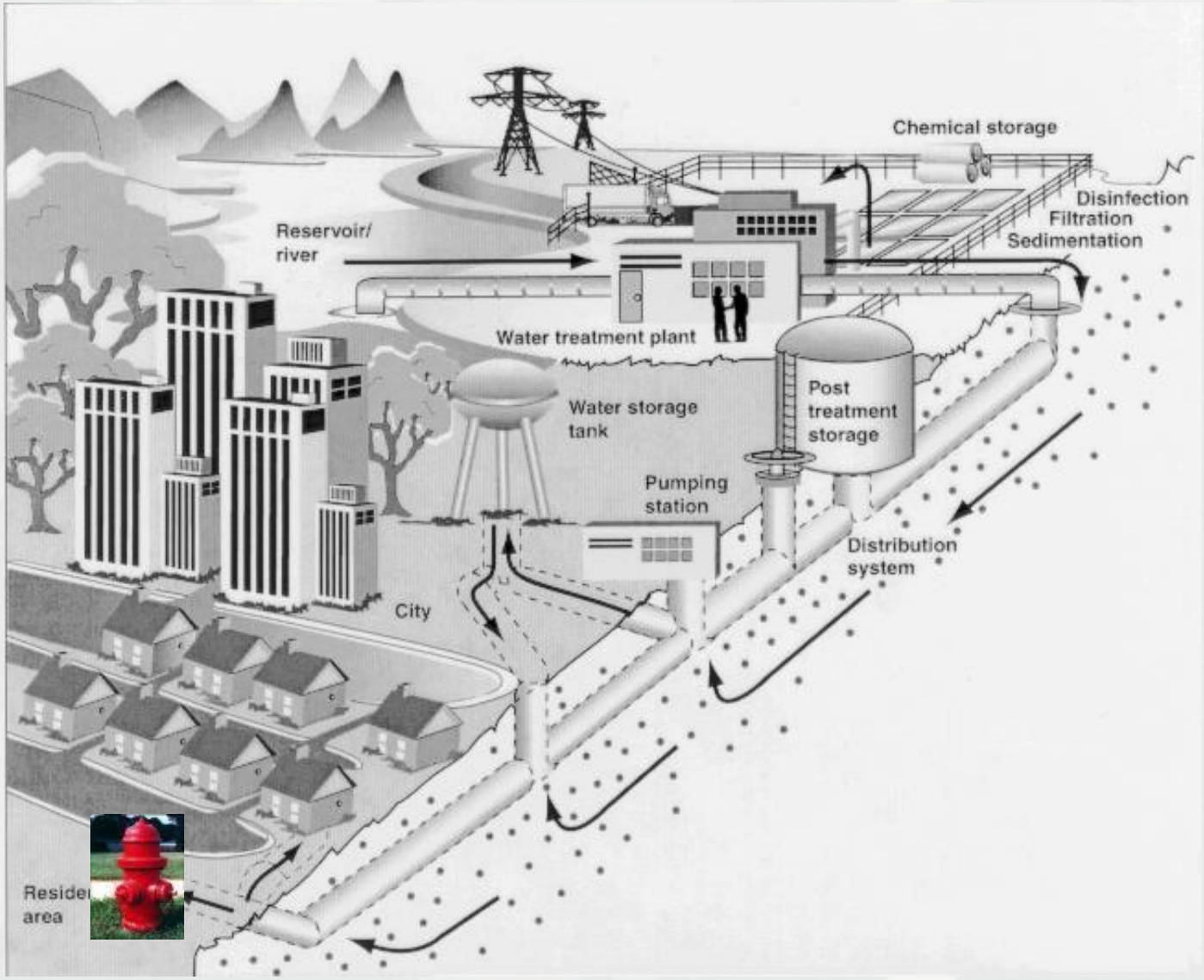
US Army Corps of Engineers
BUILDING STRONG®

OSD Corrosion Control Program

- Congressional Directive to DoD
  - Public Law 107-314, December 2002 Sec: 1067: Prevention and mitigation of corrosion of military equipment and infrastructure
- Tri-Service in nature
- Army facilities projects are co-funded with ACSIM-IMA
- We greatly appreciate their sponsorship, visibility, and support



Threats and Vulnerabilities



ASCE 2009 Report Card for America's Infrastructure

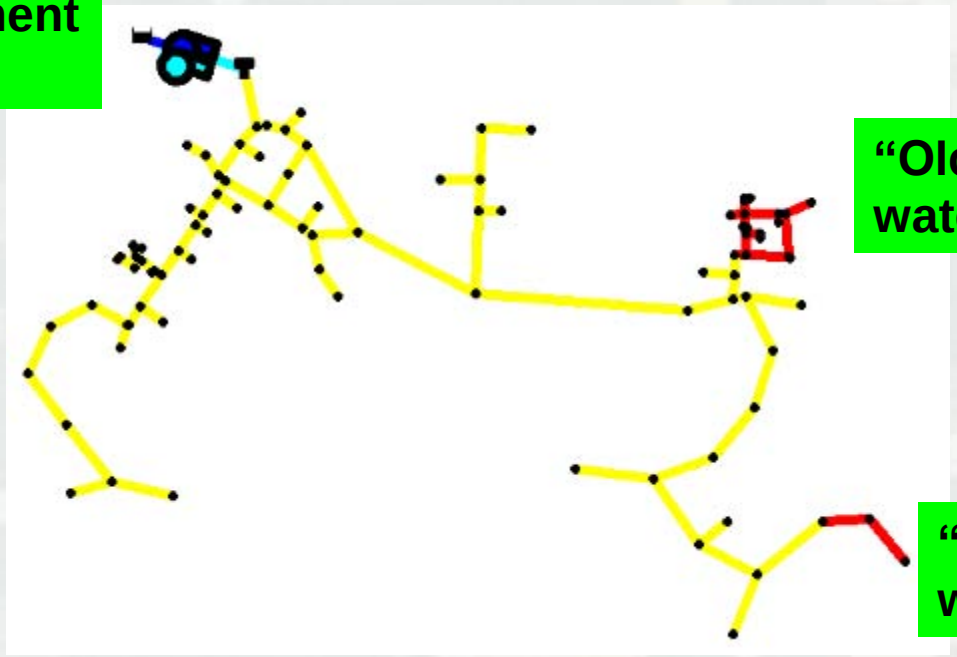
- Drinking Water : D-

Tuberculation in 6-inch Unlined Water Main

36 Inch Main Break

Degradation Of Water Quality In The Distribution System Can Result In Undetected Localized Corrosion Problems

Treatment plant



"Old" water

"Old" water

- Corrosion inhibitors and disinfectants are consumed
- Residence time controlled by system hydraulics
- Remote and low-use areas are especially problematic

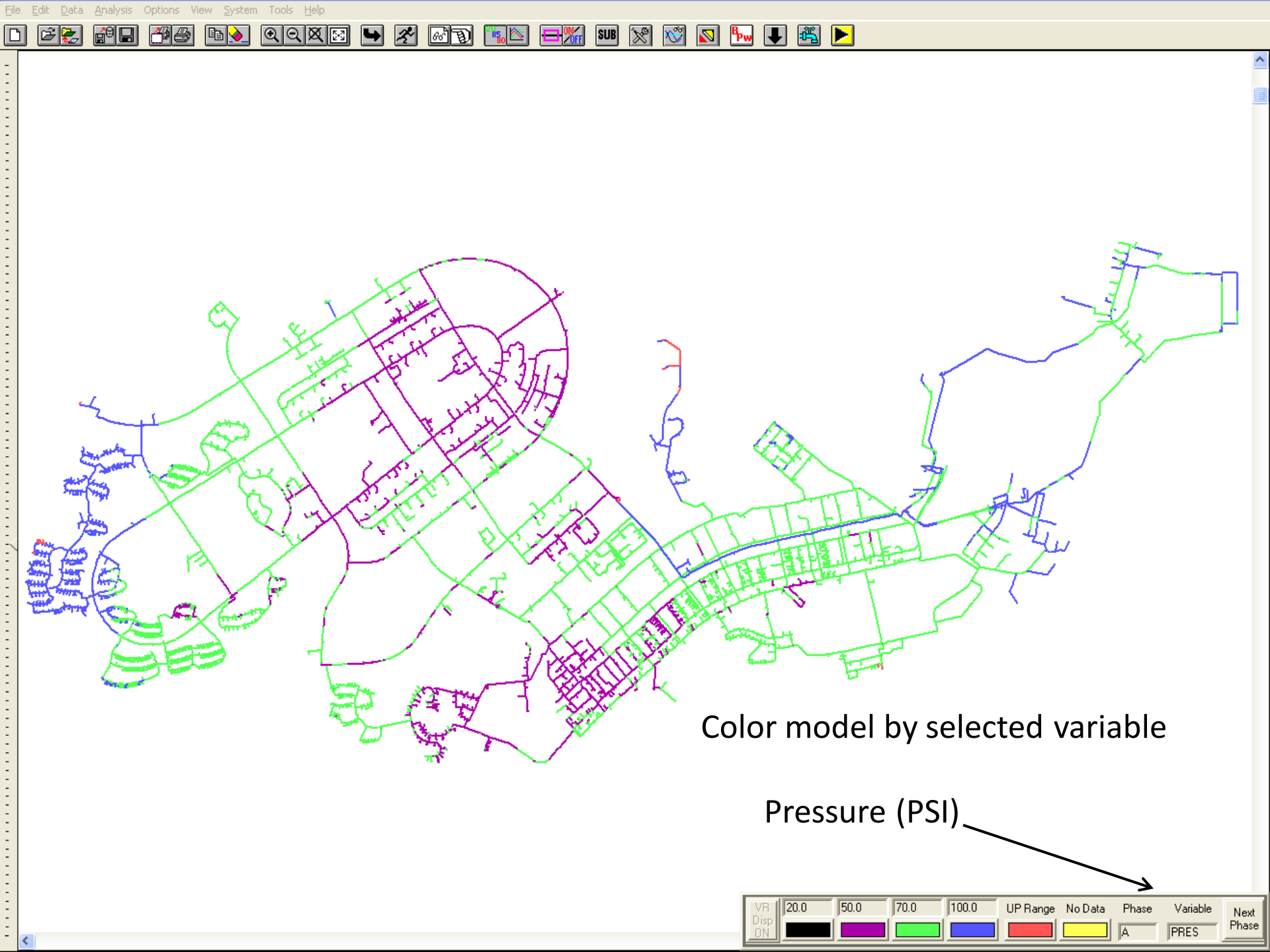
EXTENT AND MAGNITUDE OF THE CORROSION PROBLEM

- Potable Water Distribution System: 880,000 miles of pipe comprise the nation's drinking water distribution network [AWWA WATER\STATS2002].
- Millions of fire hydrants are associated with the network.

If the condition of a pipeline is unknown, or if insufficient data is available to make an accurate assessment of the pipeline condition, then managers cannot be situationally aware and make sound decisions related to:

- Rehabilitation
- Replacement funding
- Schedules
- Priorities for these assets

Monitoring at an Army Installation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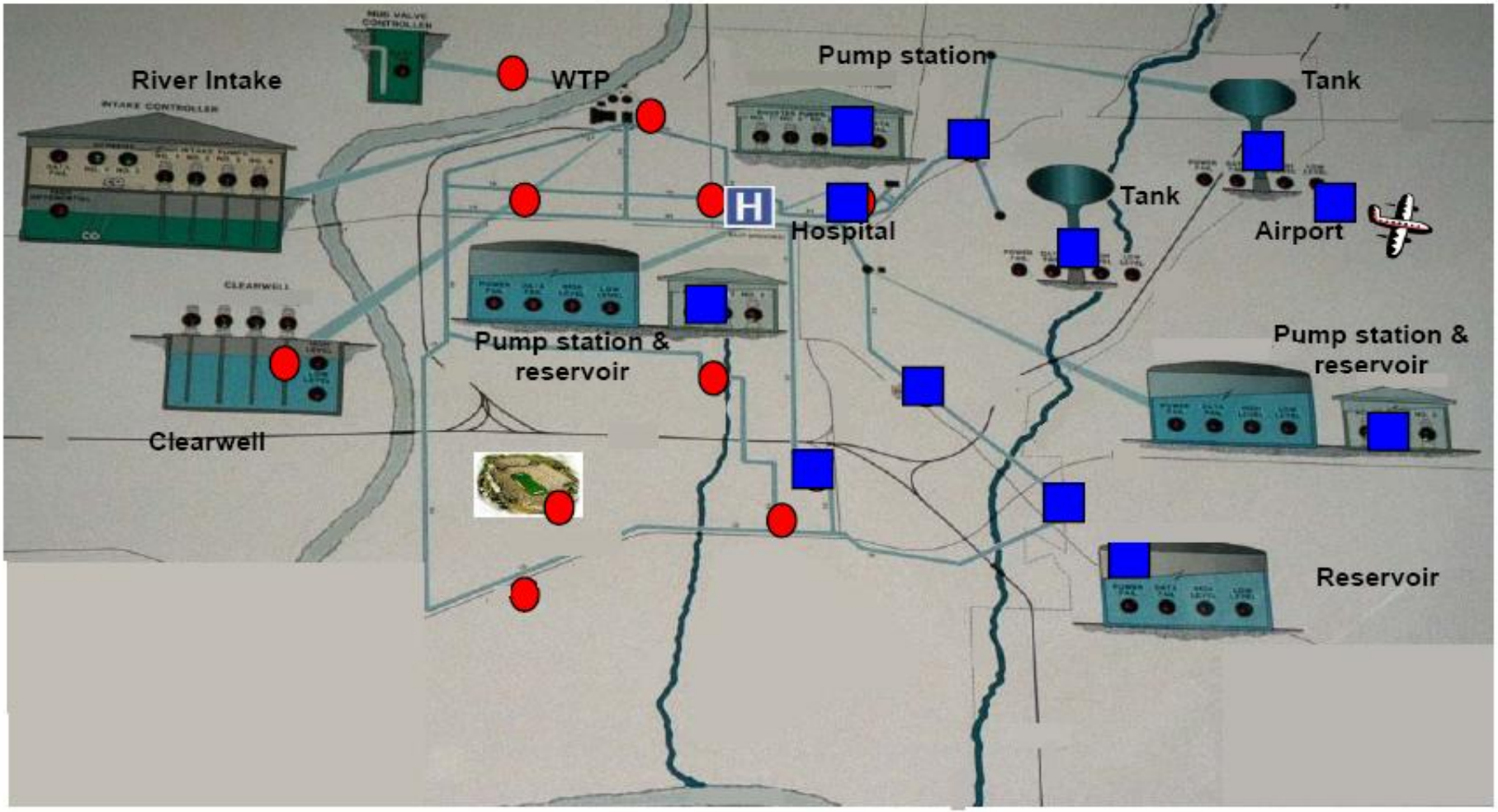
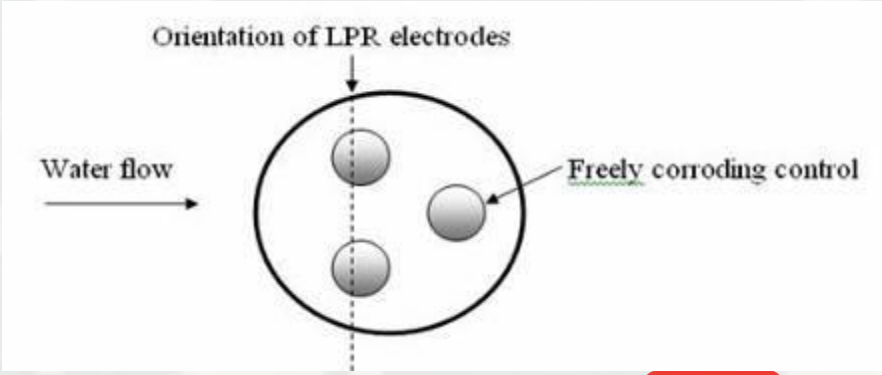
Best Approach is a Network Approach

Not a choice of just one, or two instruments



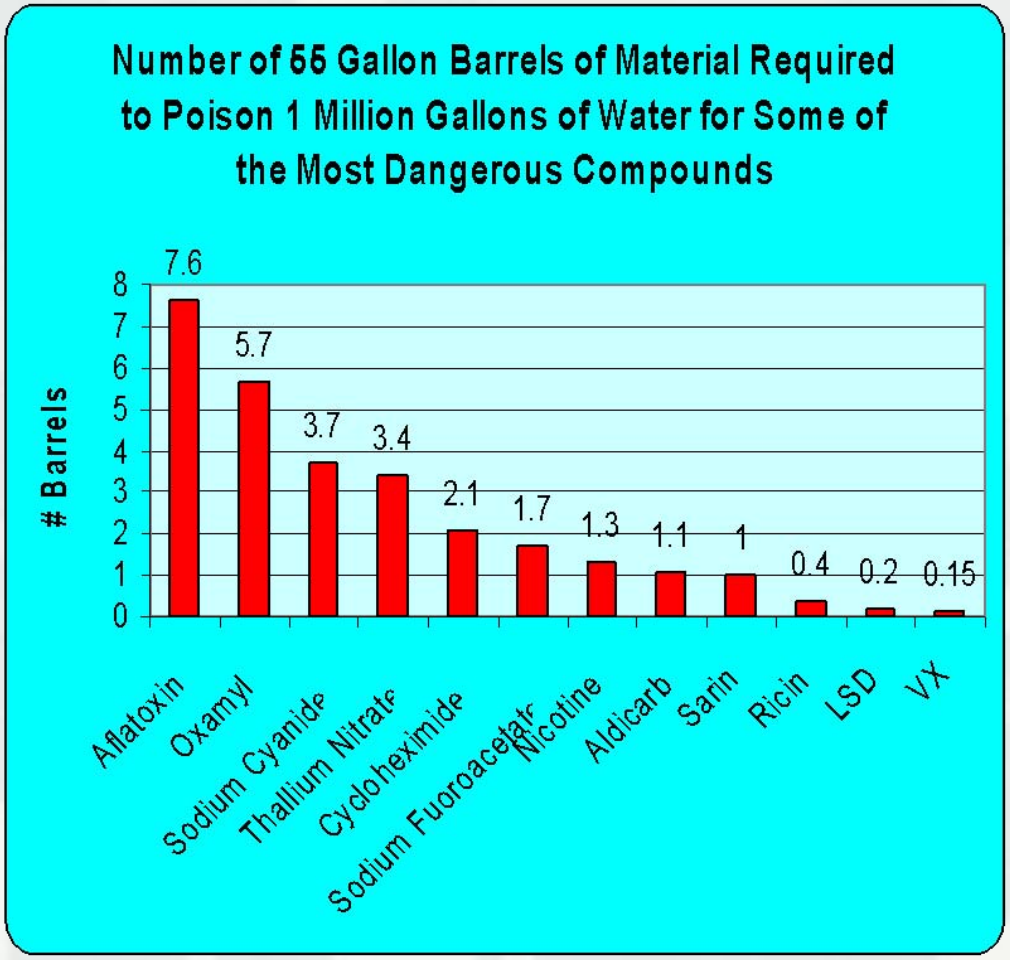
Corrosion Rate Sensor

- Measures linear polarization resistance (LPR) or electrical resistance (ER)
- Calculates instantaneous corrosion rate (LPR)
- Rate can be integrated over time for cumulative metal loss
- “Corrosion imbalance” provides qualitative indication of pitting tendency
- Can be tied in with SCADA systems/ 4-20 mA output



PipeSonde In-Pipe Multiple Parameter Probe for Water Distribution Systems

Gates and Locks – not the complete security solution



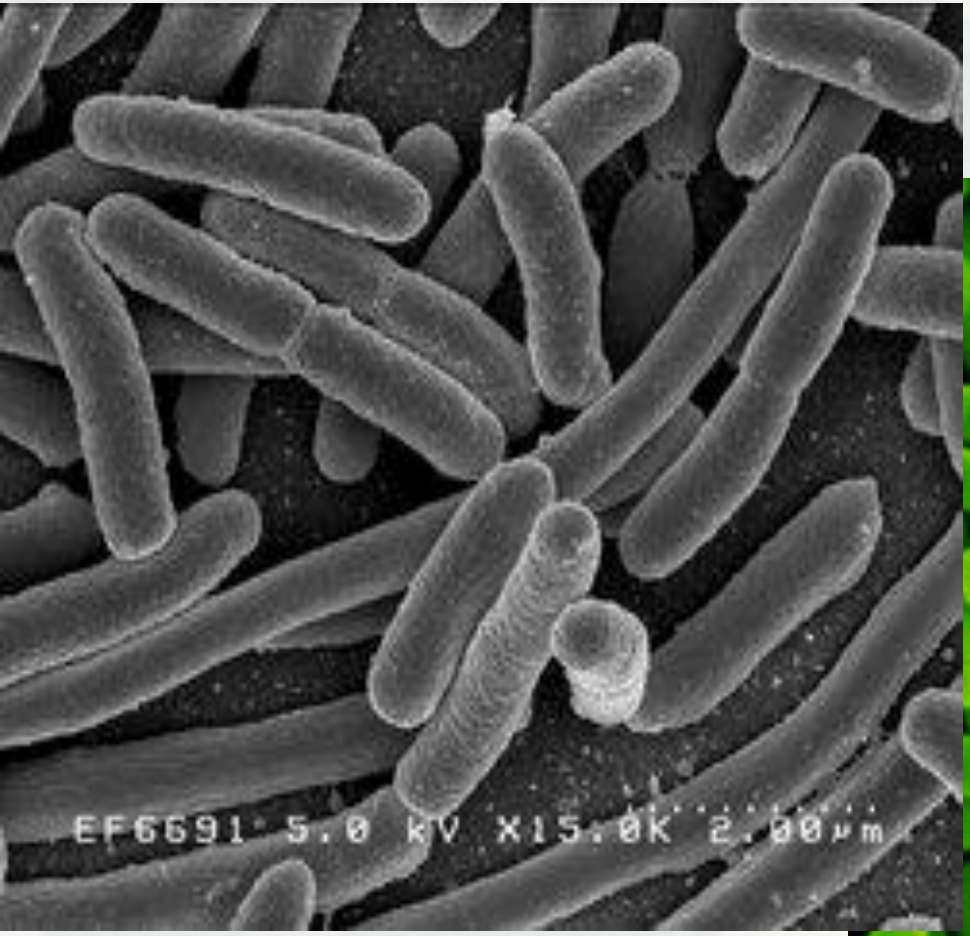
Tanker trucks are not necessary to Contaminate Water Supplies!

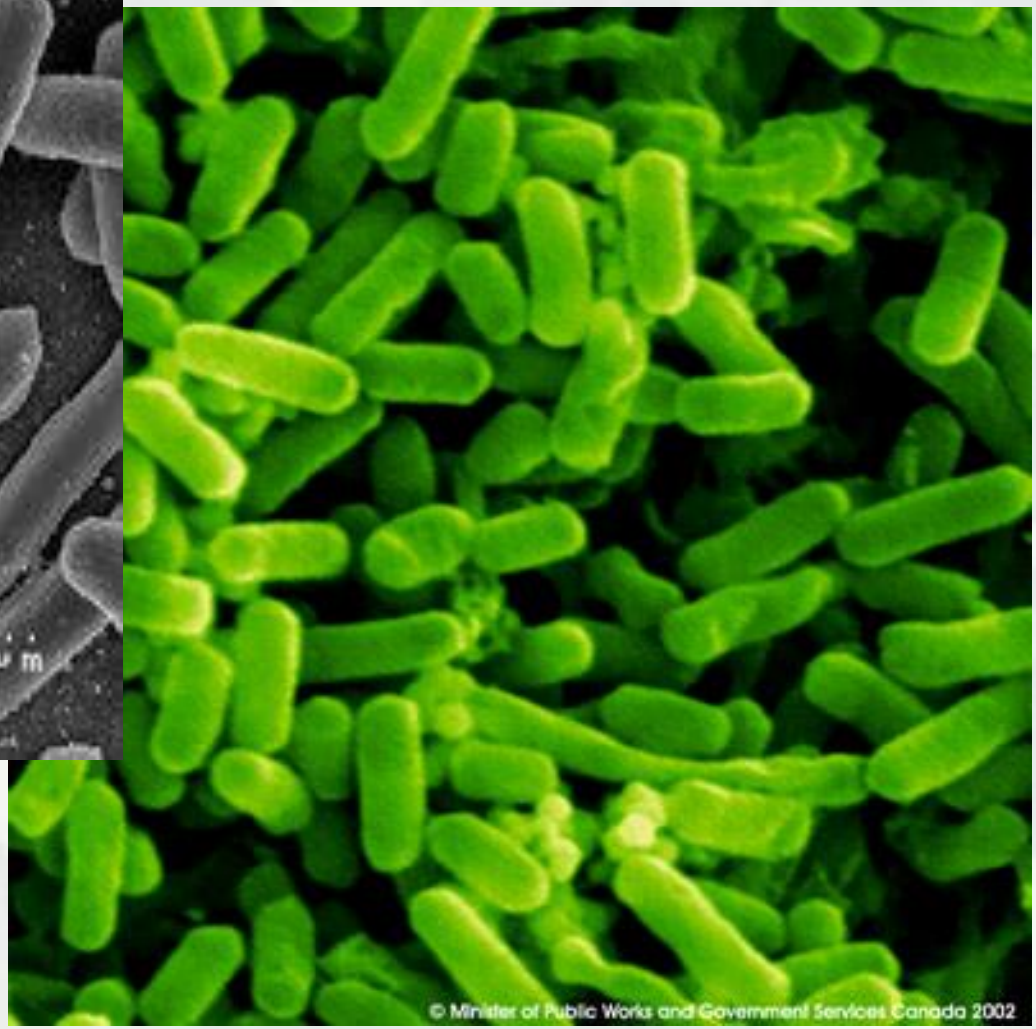
Measured as Solids

Most Serious Agents	55 Gal drums per 10^6 Gallons Water	General Comments
Aflatoxin	7.6	Potent Carcinogen
Aldicarb	1.1	
Cycloheximide	2.1	
LSD	0.2	Highly Toxic, Psychoactive
Mercuric Chloride	0.2	
Oxamly	5.7	Readily available
Ricin	0.4	
Sodium Cyanide	3.7	Fast acting, readily available
Sodium Fluoroacetate	1.7	Tasteless, Colorless, Odorless
Thallium Nitrate	3.4	
Sarin	1	
VX	0.15	

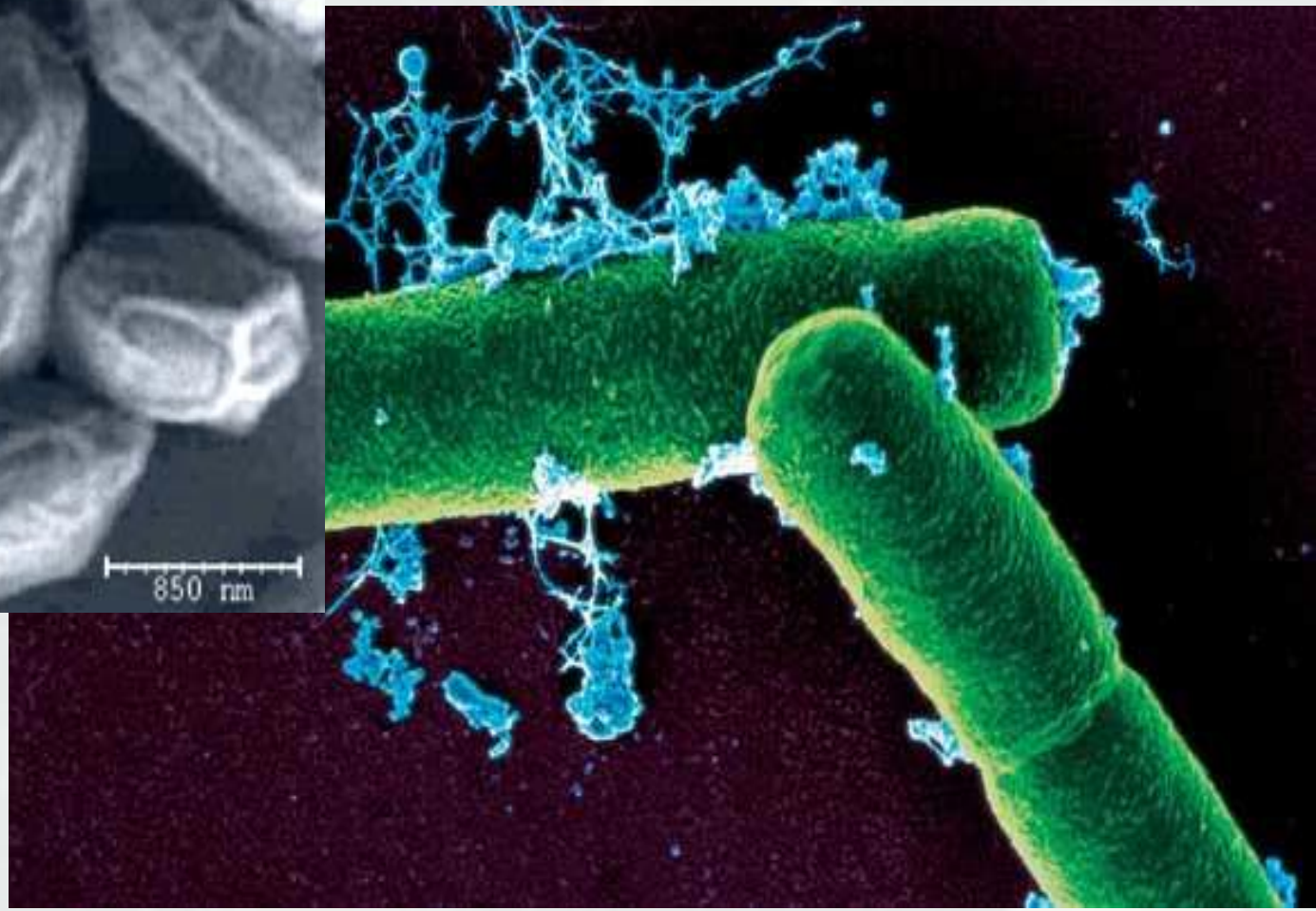
Liquid

Escherichia Coli

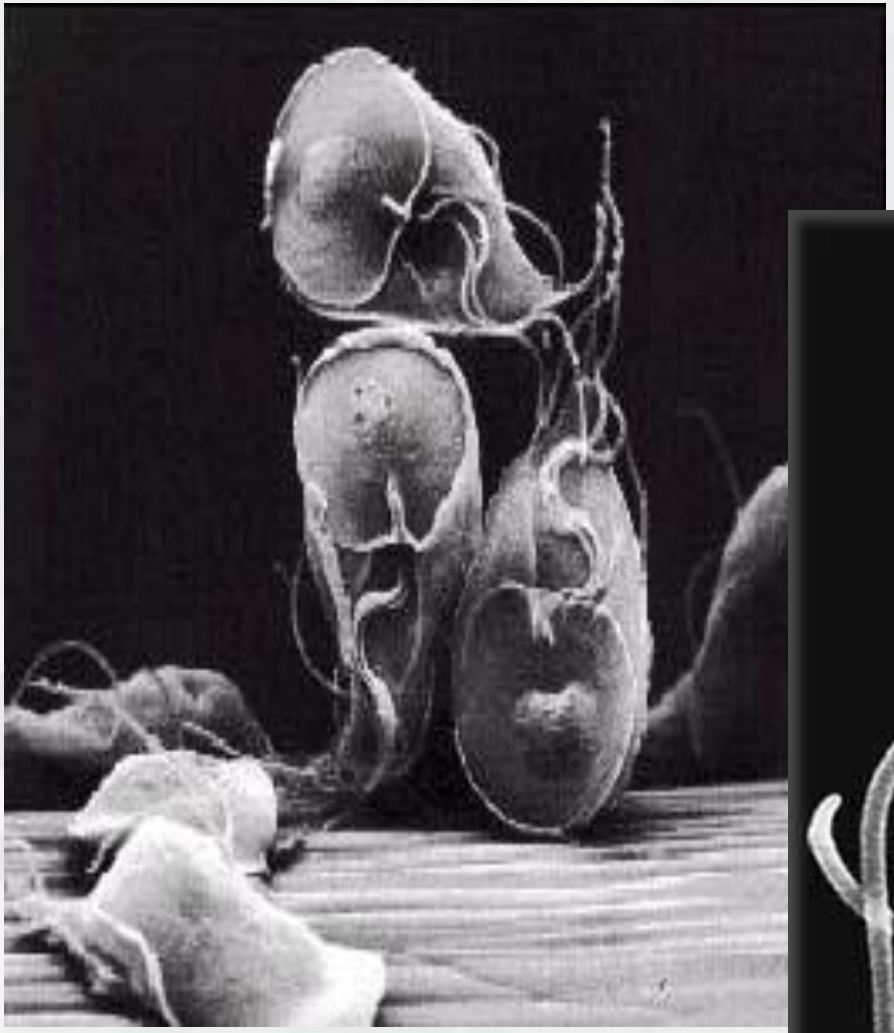


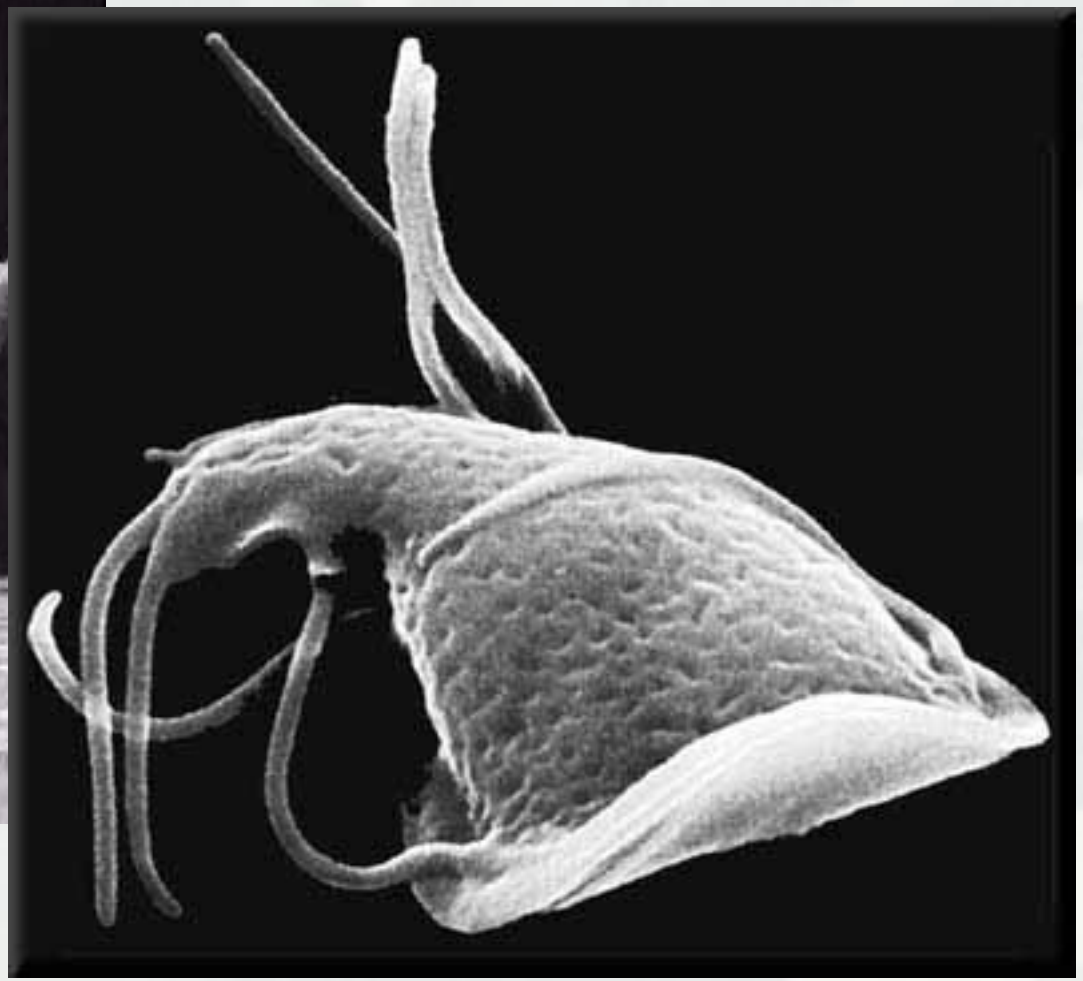


Anthrax - Spores and Vegetative

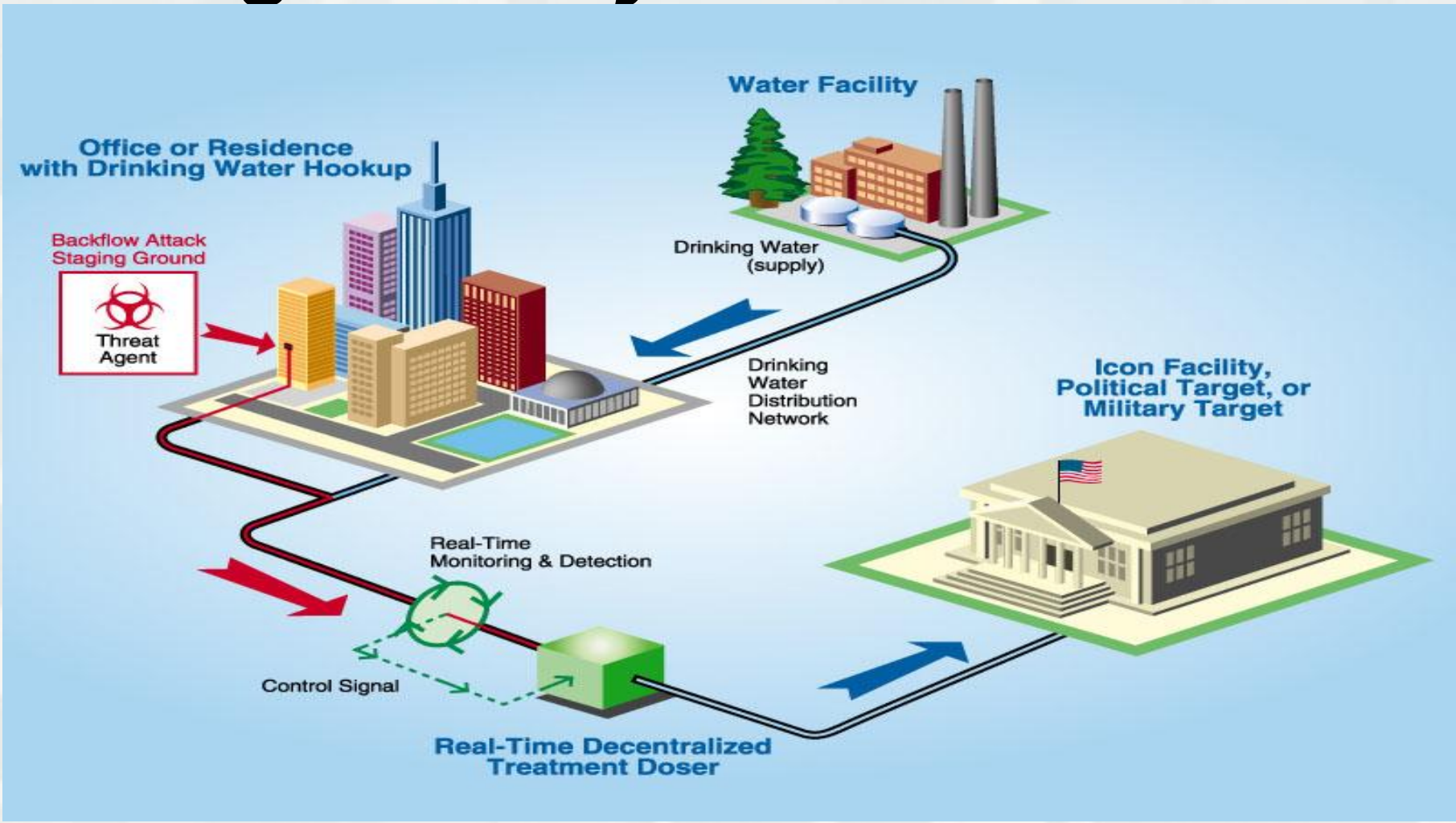


Giardia duodenalis





Integrated System Protection



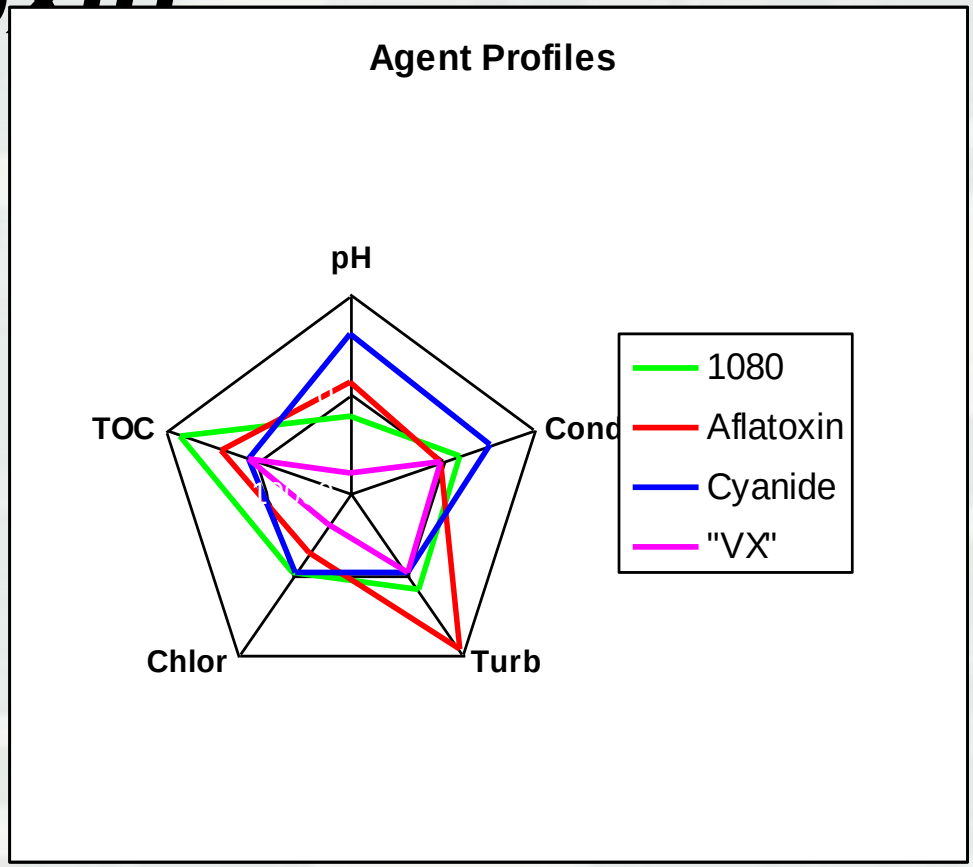
GuardianBlue Early Warning System

The First and Only drinking water early warning system certified by the Department of Homeland Security as approved product for homeland security

- Protect Public Health
- Detect and classify events in the distribution system
- Increase security
- Streamline operations

Approach: Detection by "Fingerprint Signature" of the Toxin

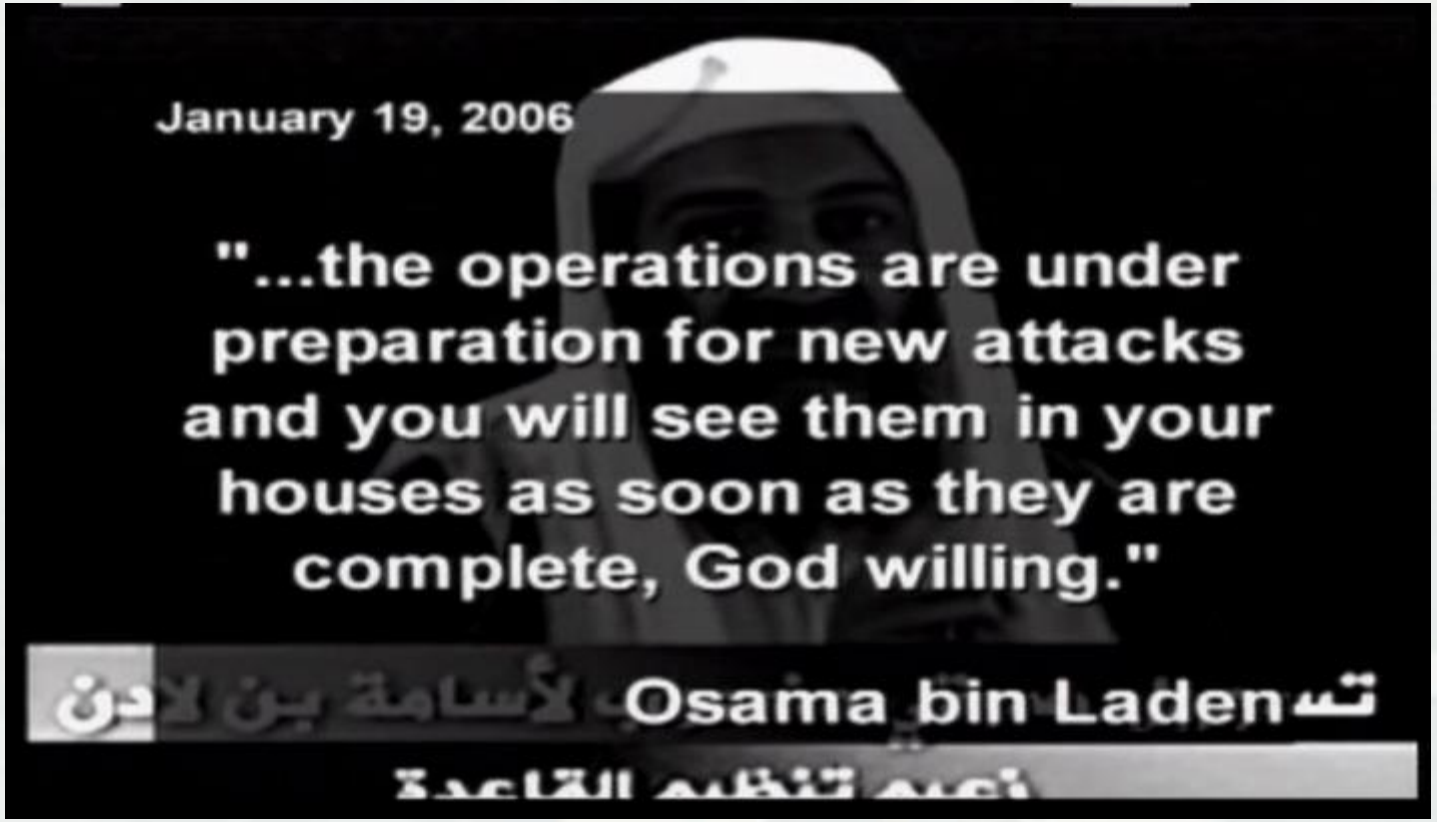
- HACH sensor capable of determining contaminant type from water quality data (TOC, chlorine, pH, etc. as a "generalized vector").
- Hach sensor is equipped with a library of water quality responses to ~100 classes of agent.



Beijing Olympics

- GuardianBlue Systems selected for securing drinking water during the recent Beijing Olympic games.


تسجيل صوتي منسوب لأسامة بن لادن


January 19, 2006
"...the operations are under preparation for new attacks and you will see them in your houses as soon as they are complete, God willing."
Osama bin Laden

Methods – Physical Attack

- Denial of service and collateral damage

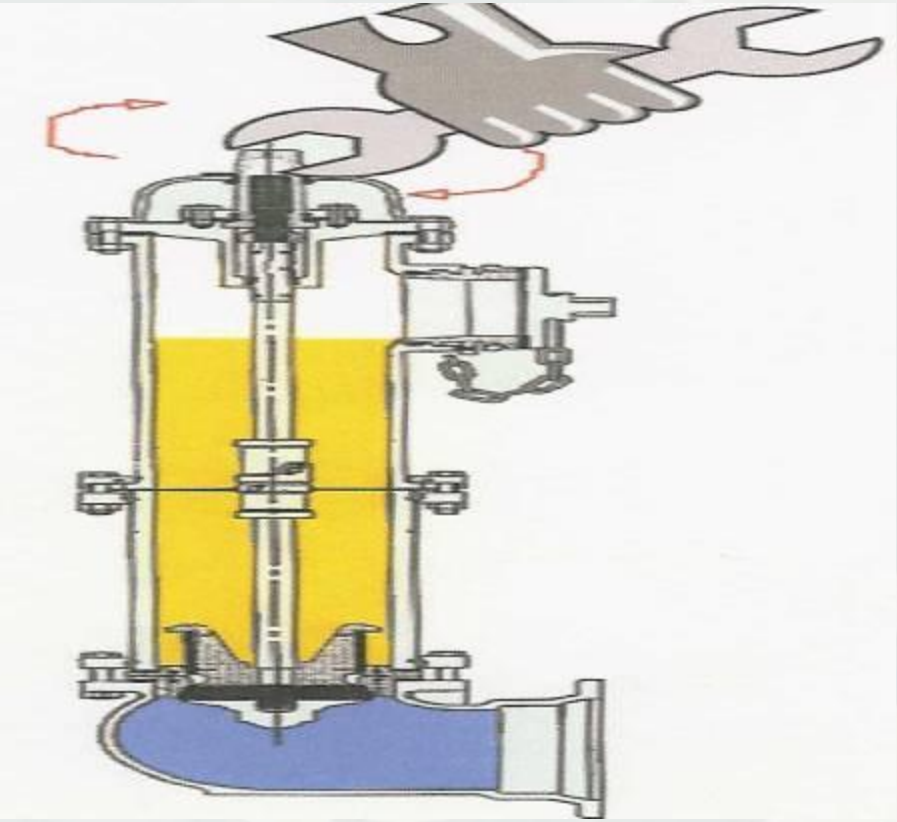
A single terrorist (international, or domestic) can be up and running to attack a water system within days of arrival at target site.

Attack Scenario

- ***12 gallons of readily available toxic substance***
- ***pump ($150 rental)***
- ***wrench to open a fire hydrant ($10)***

- *One (1) terrorist, or equivalent, intent upon killing innocent people.*

THE THREAT




VACTOR
RAM JET

US ARMY_NAVY CBR CONTAMINATION AND COUNTERMEASURES REPORT

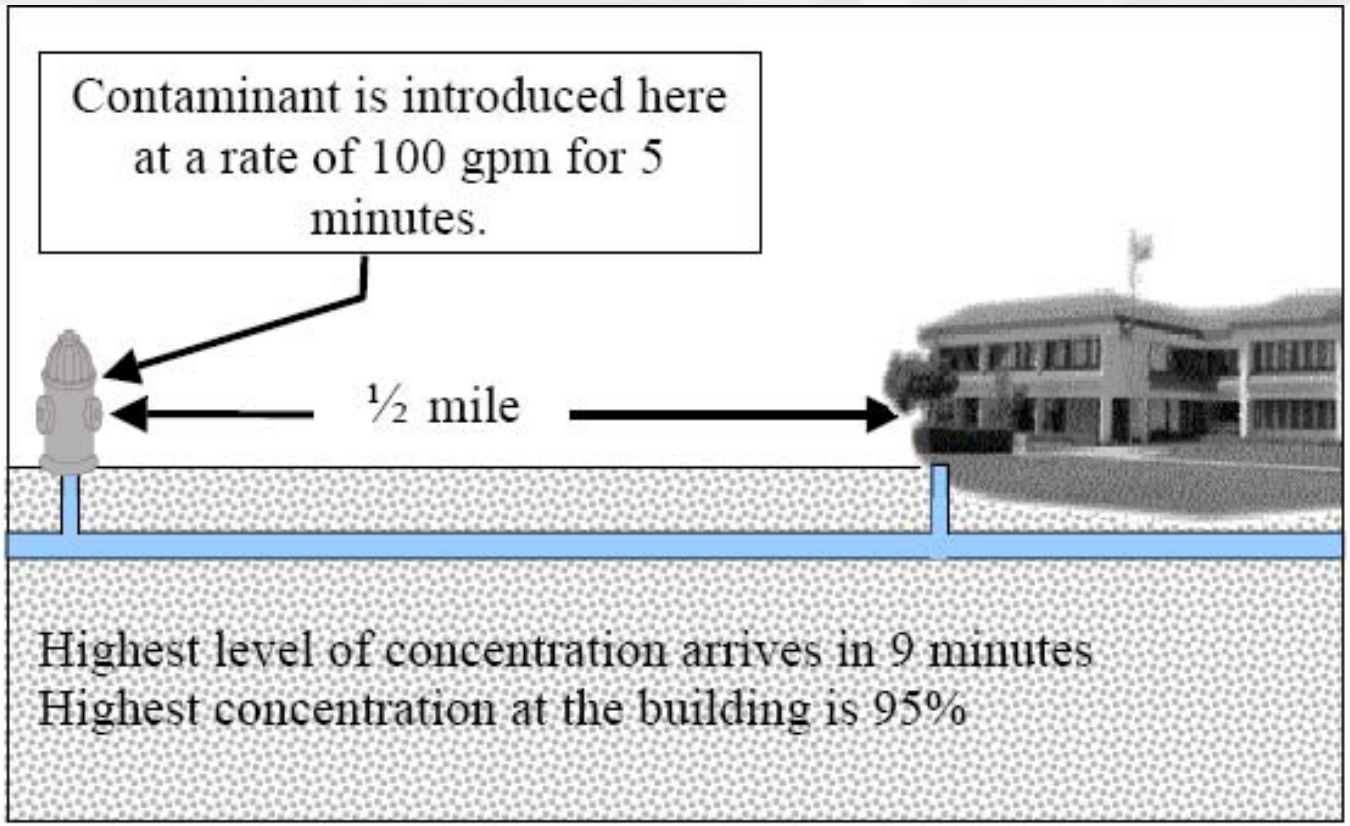
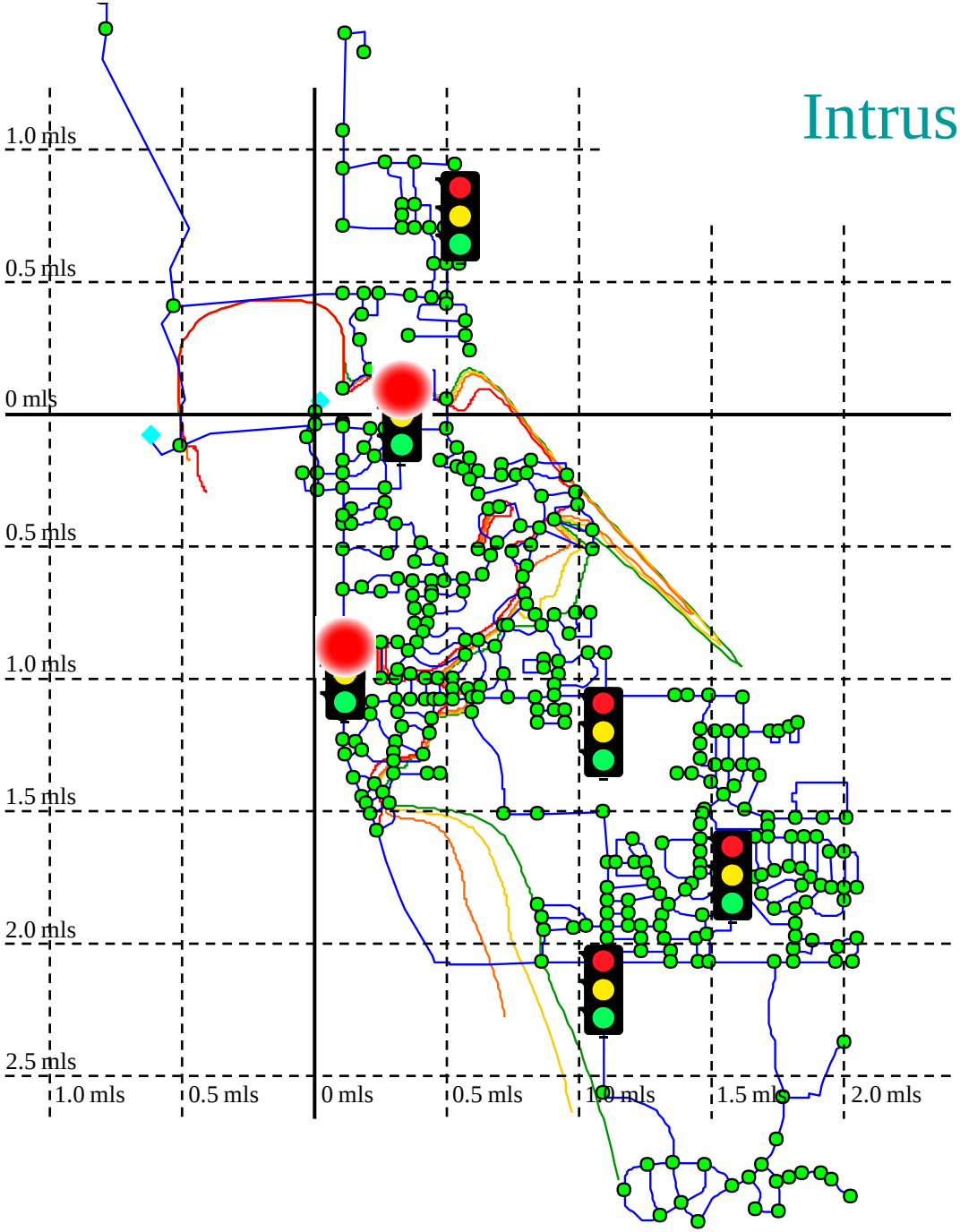
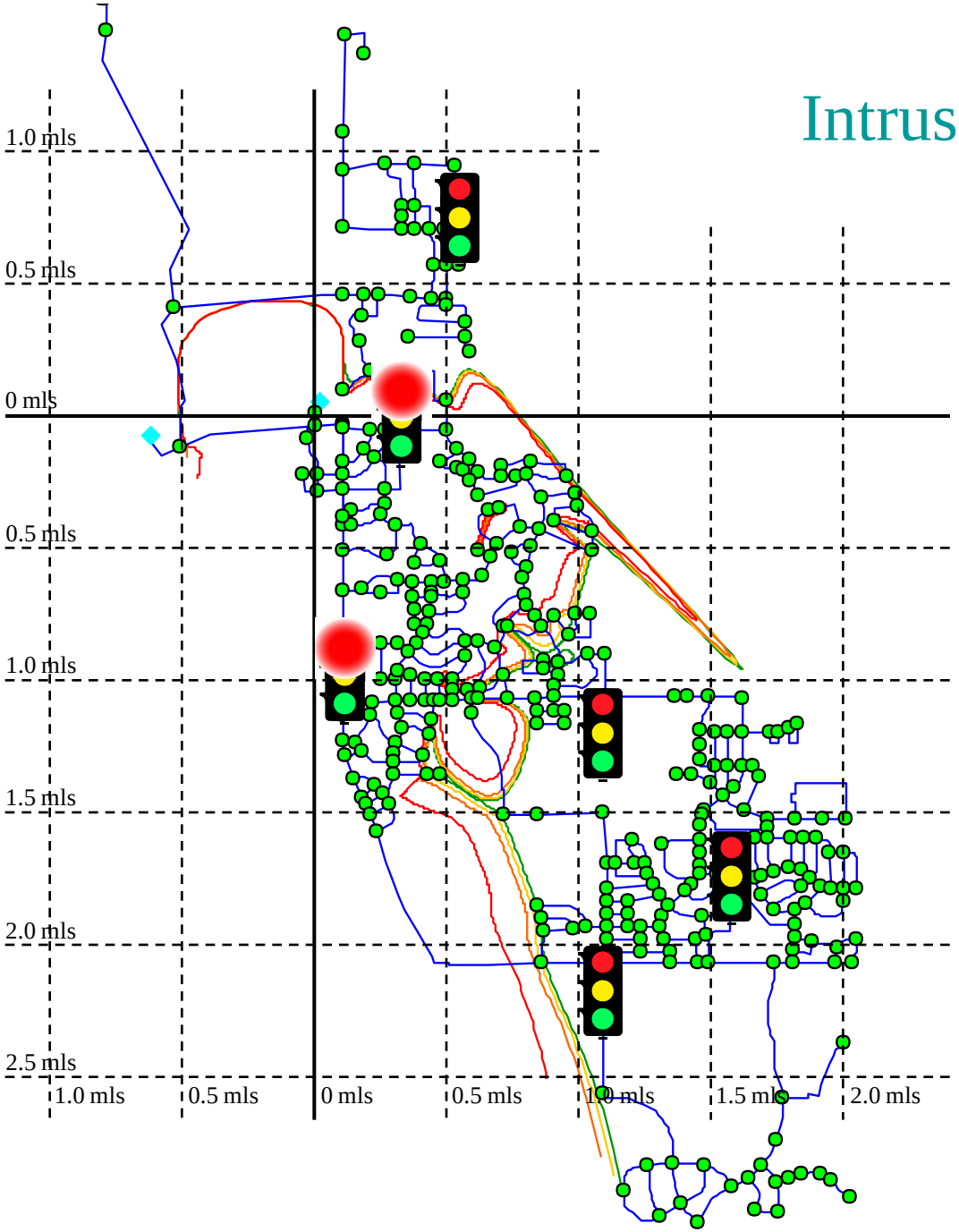


Figure1. Generalized model out put for an agent injected into a fire hydrant within a 1/2 mile of a targeted building.

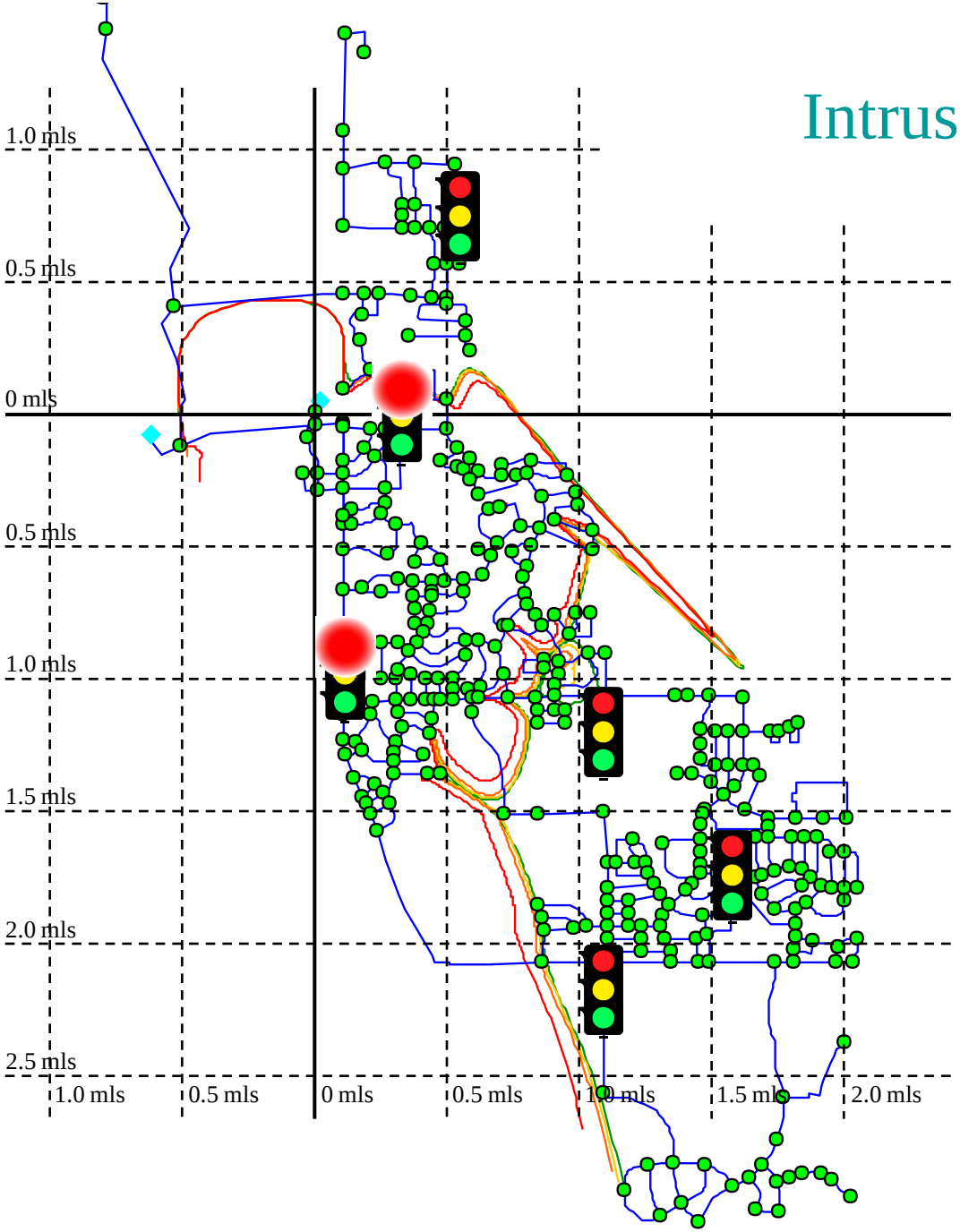
Intrusion 03:00 hours



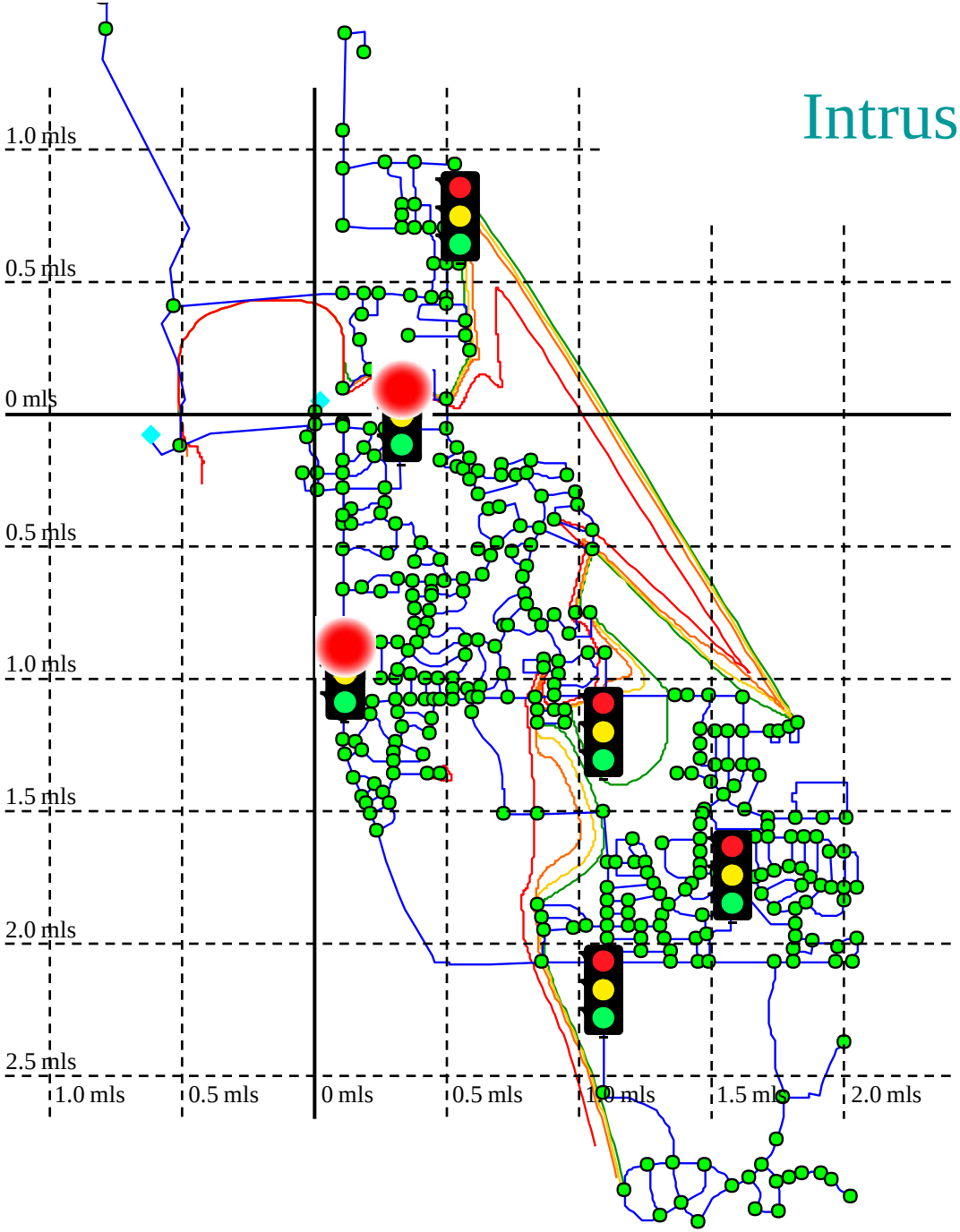
Intrusion 03:30 hours



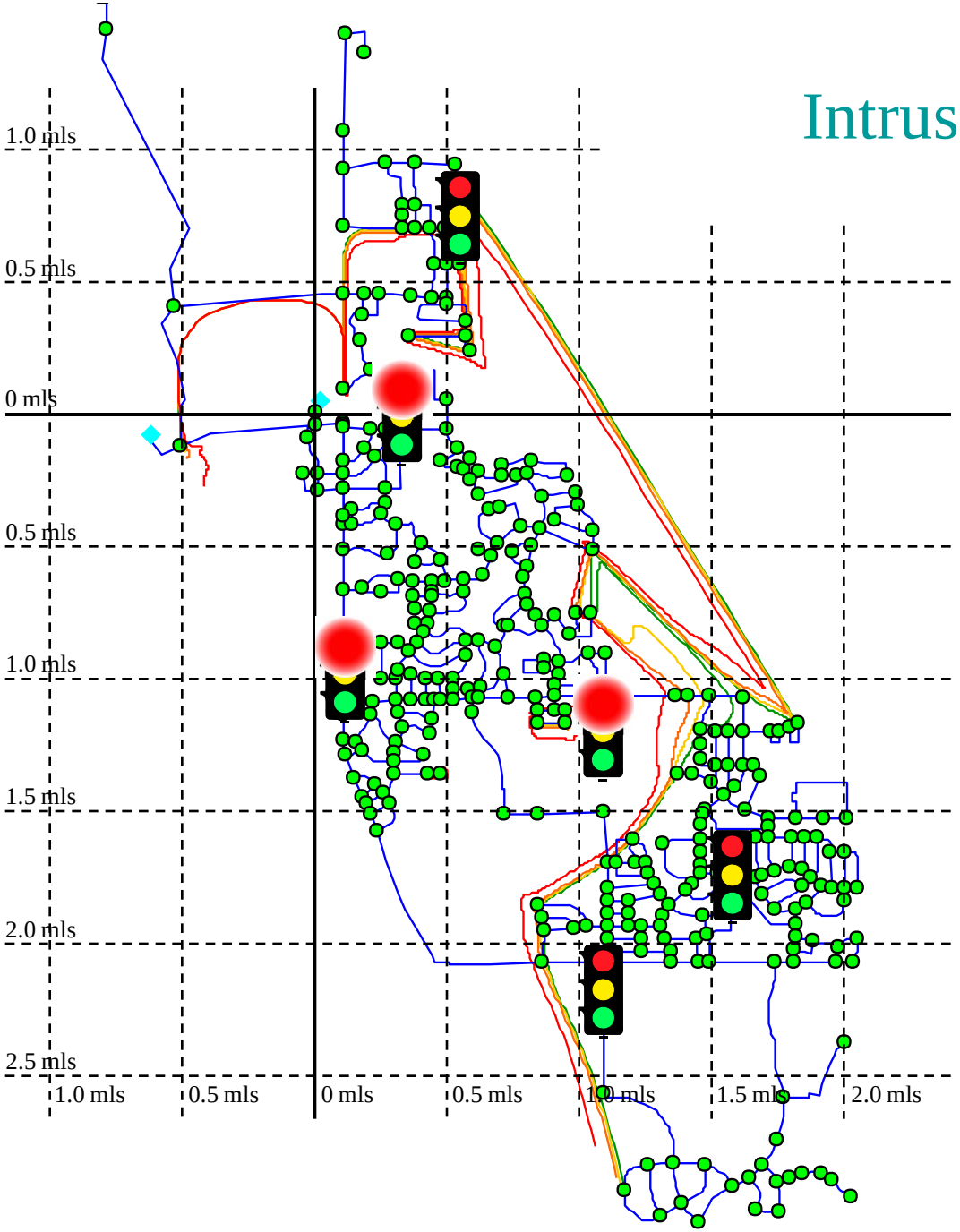
Intrusion 04:00 hours



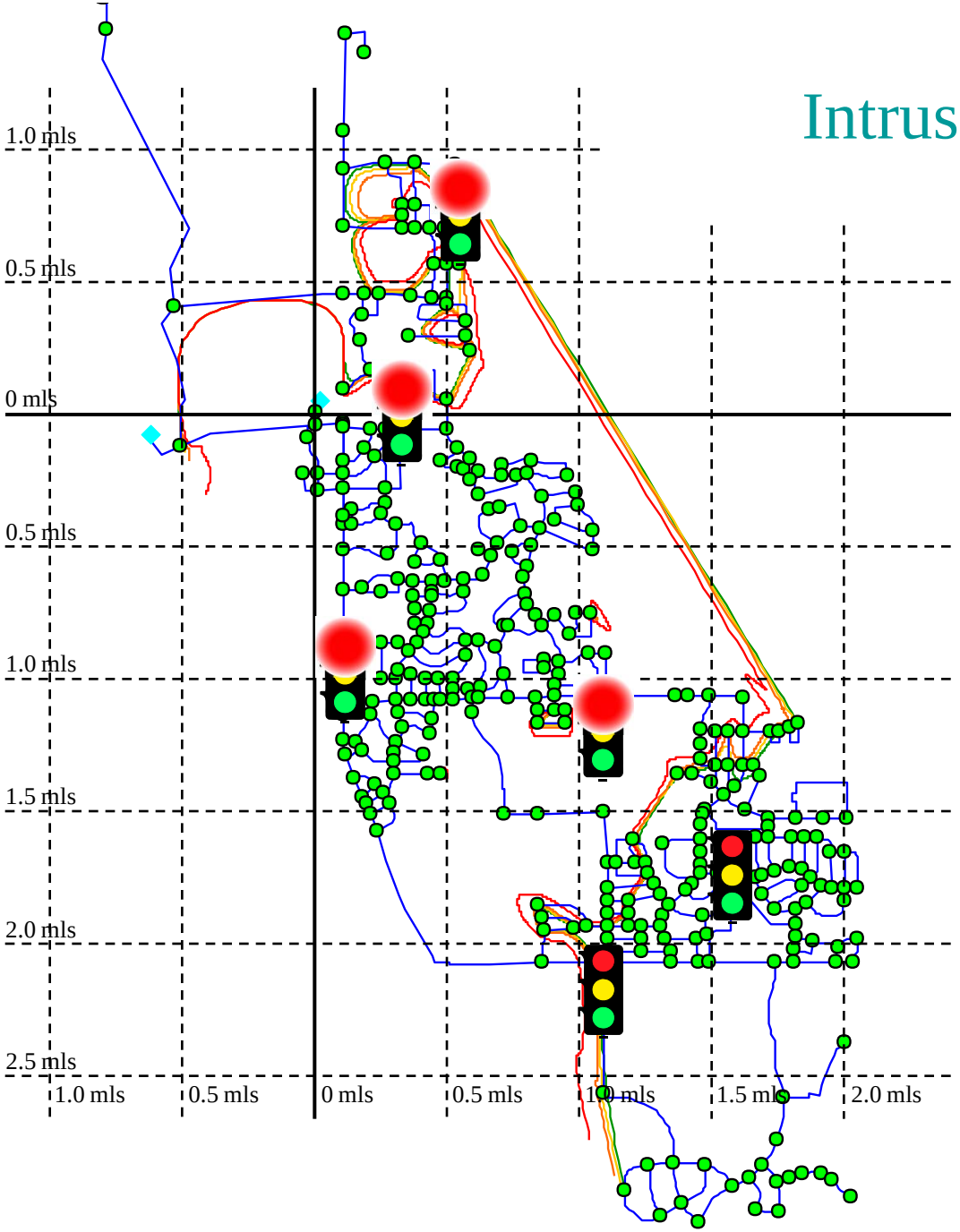
Intrusion 05:00 hours



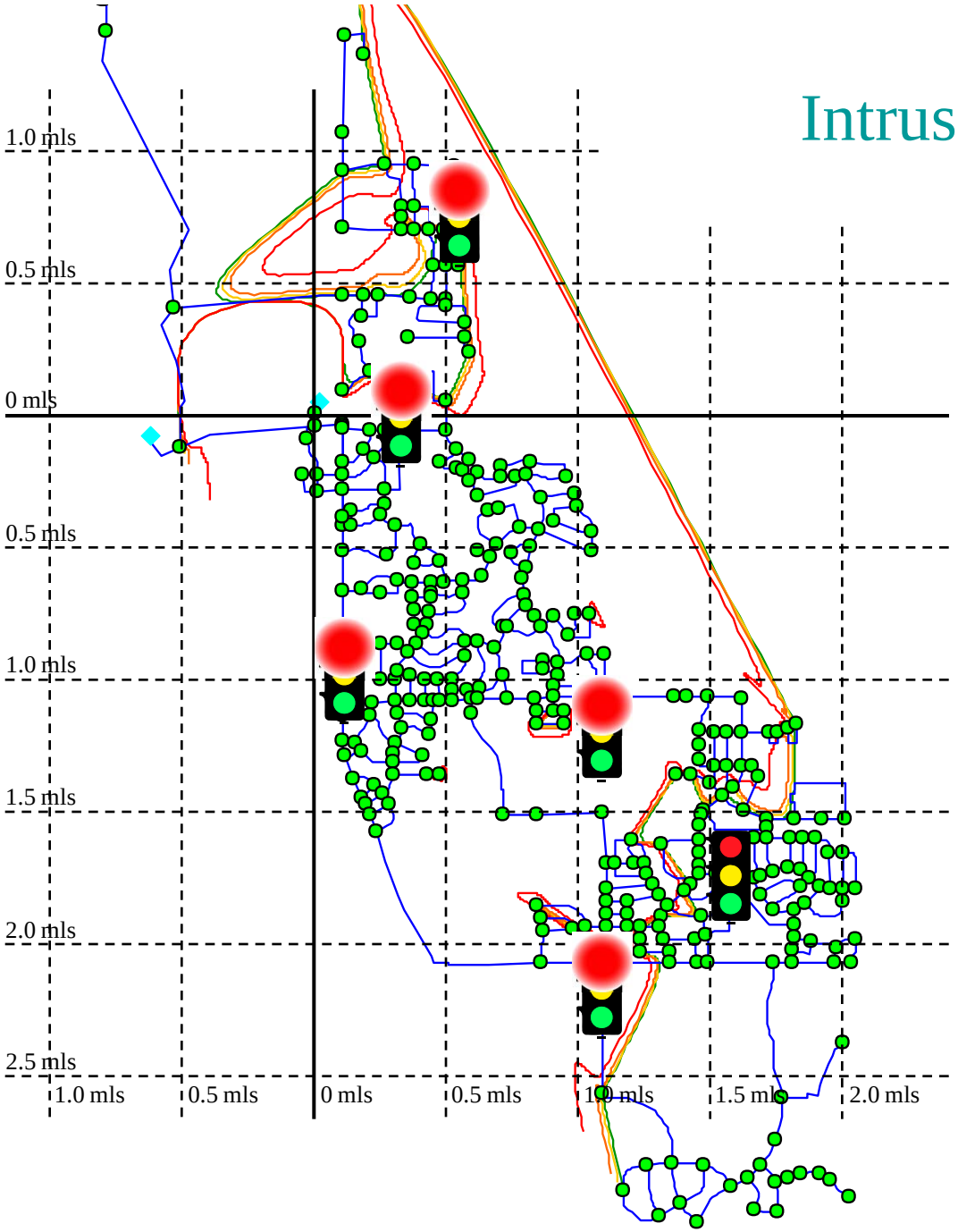
Intrusion 06:00 hours



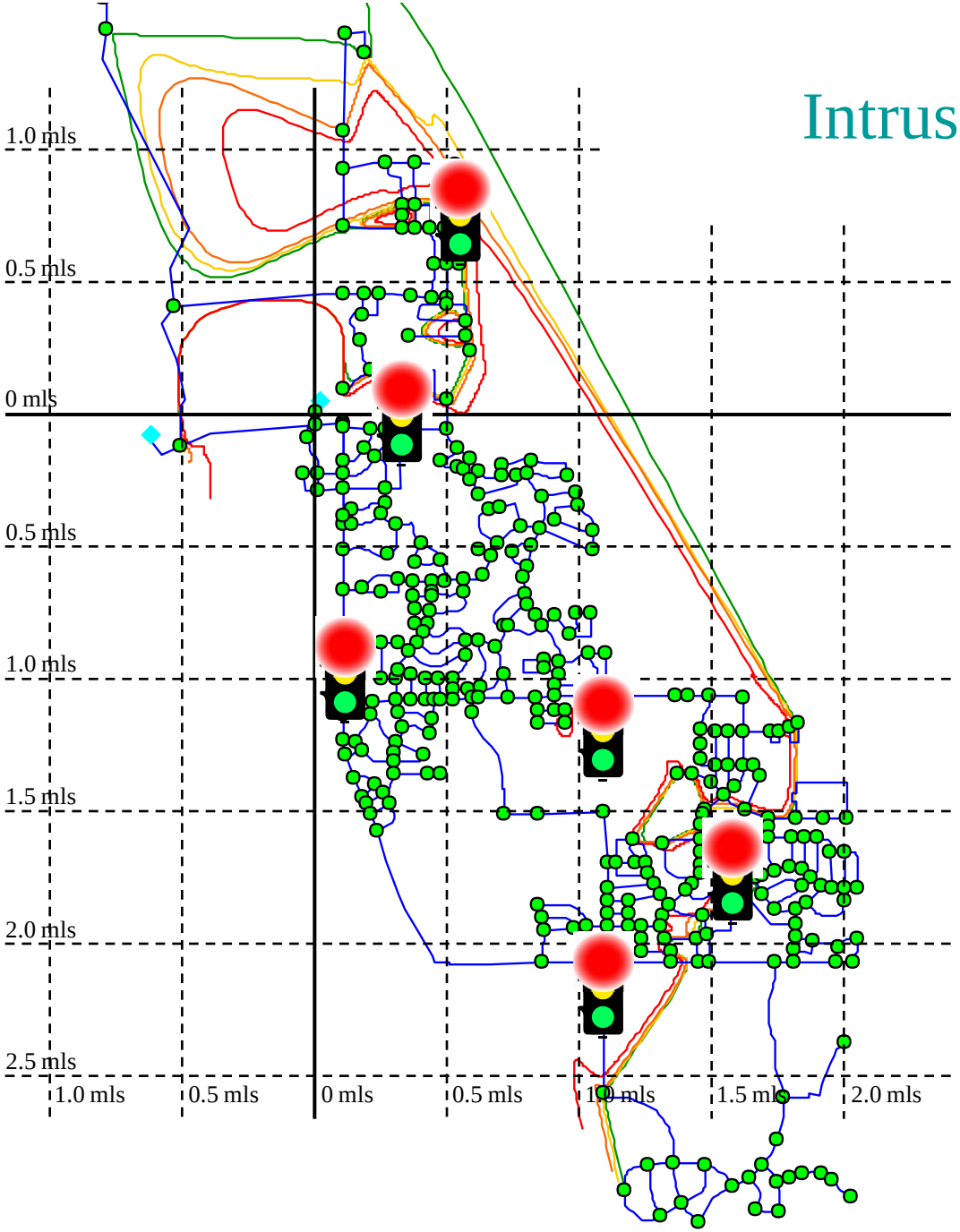
Intrusion 07:00 hours



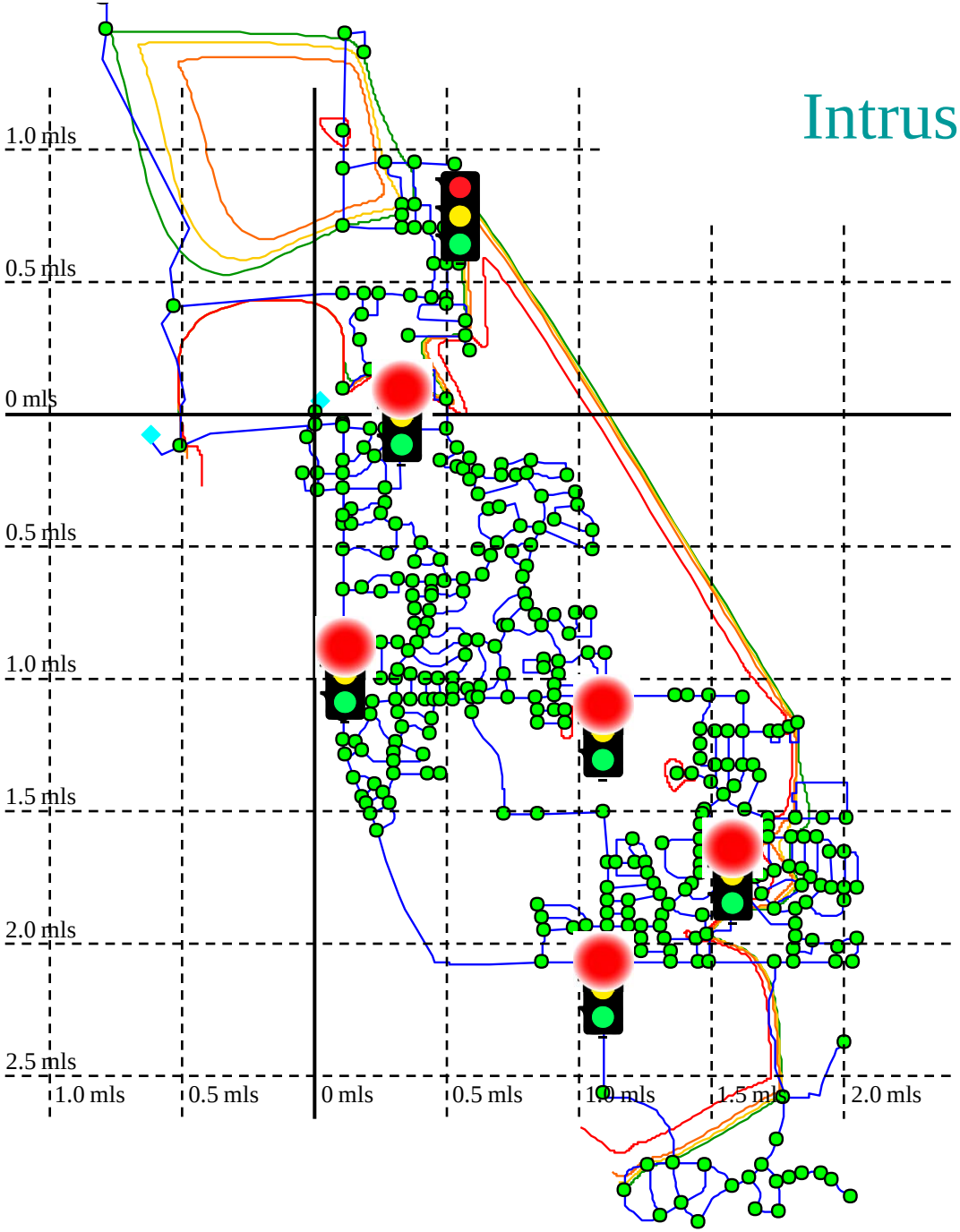
Intrusion 08:00 hours



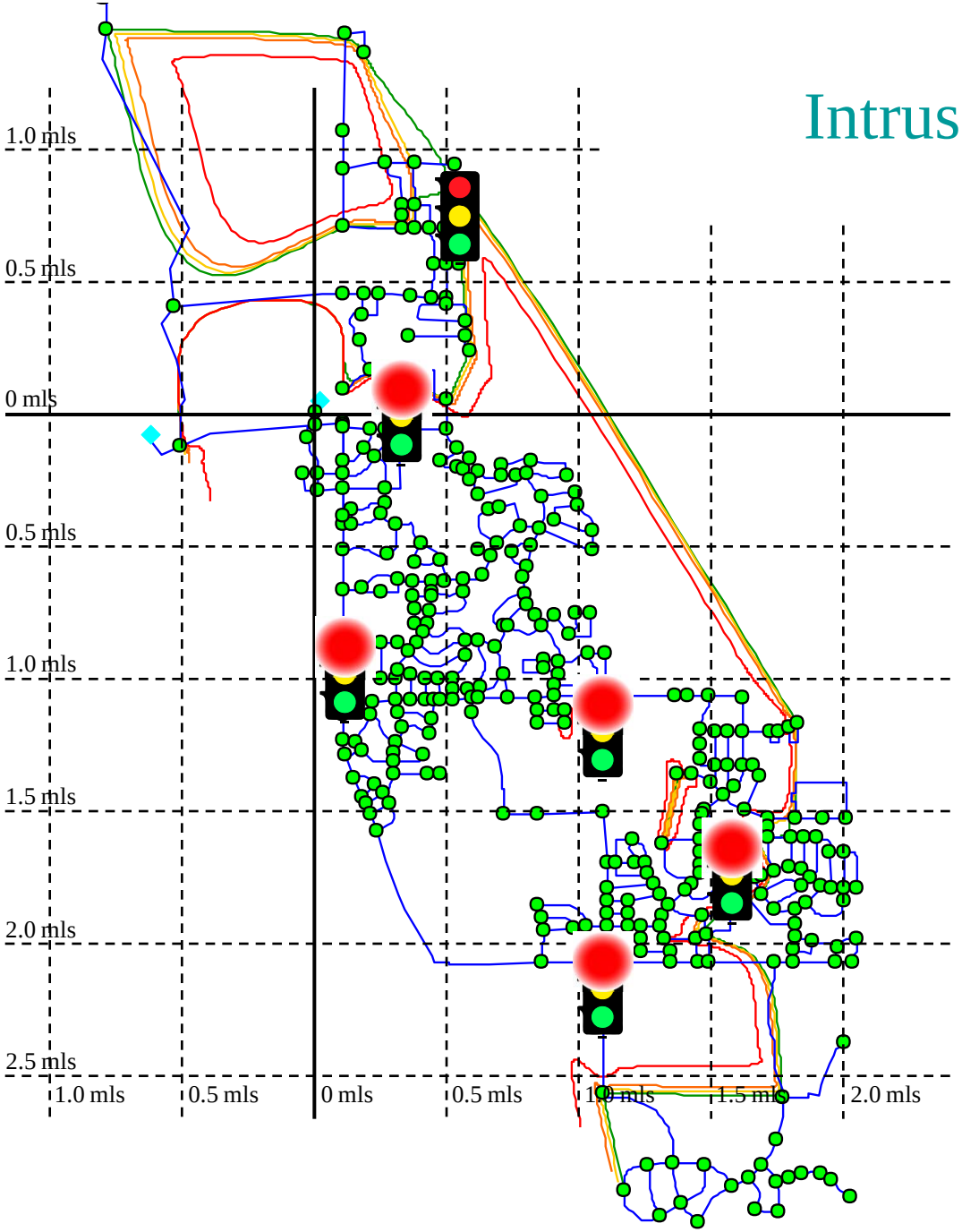
Intrusion 09:00 hours



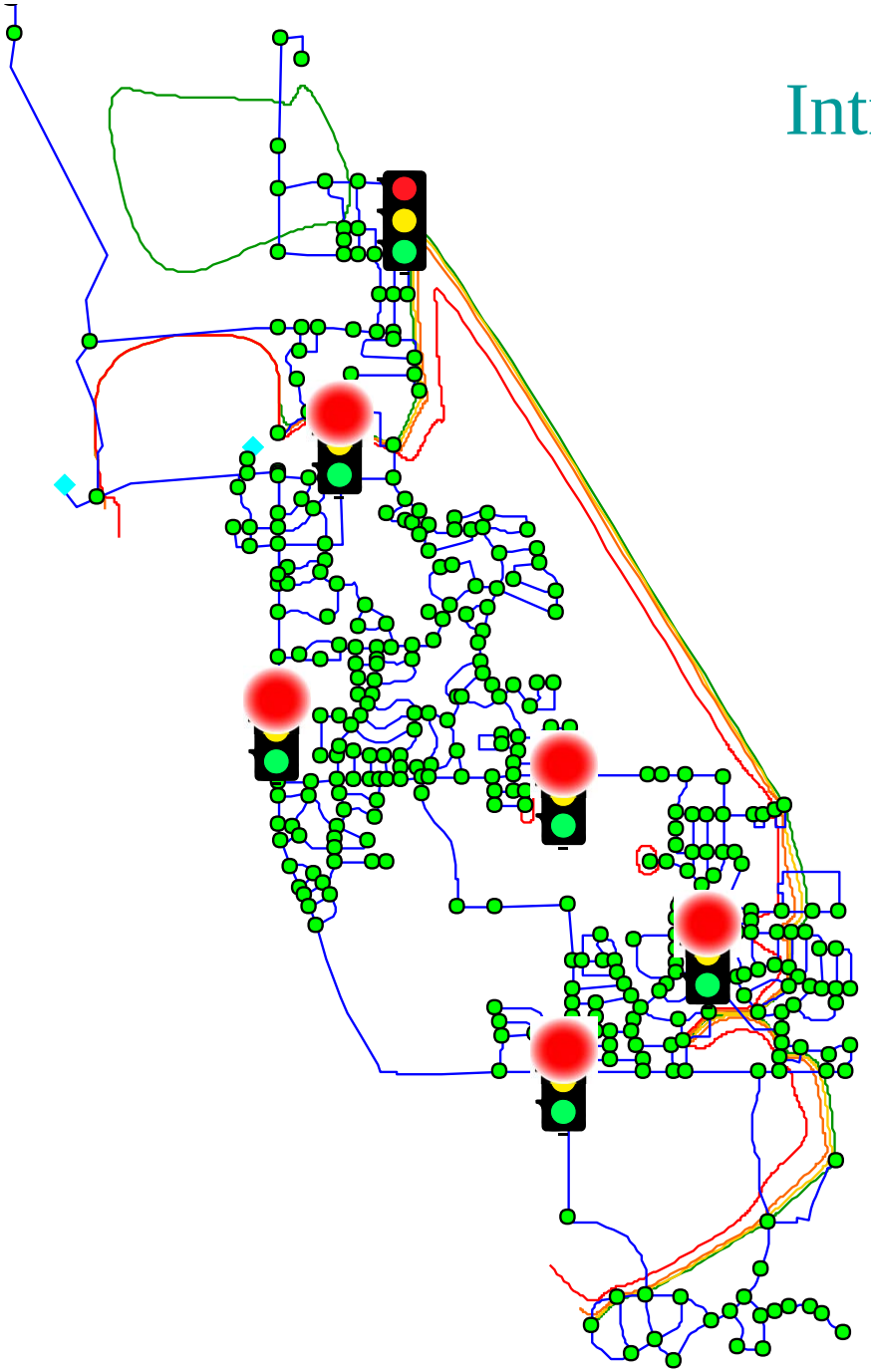
Intrusion 10:00 hours



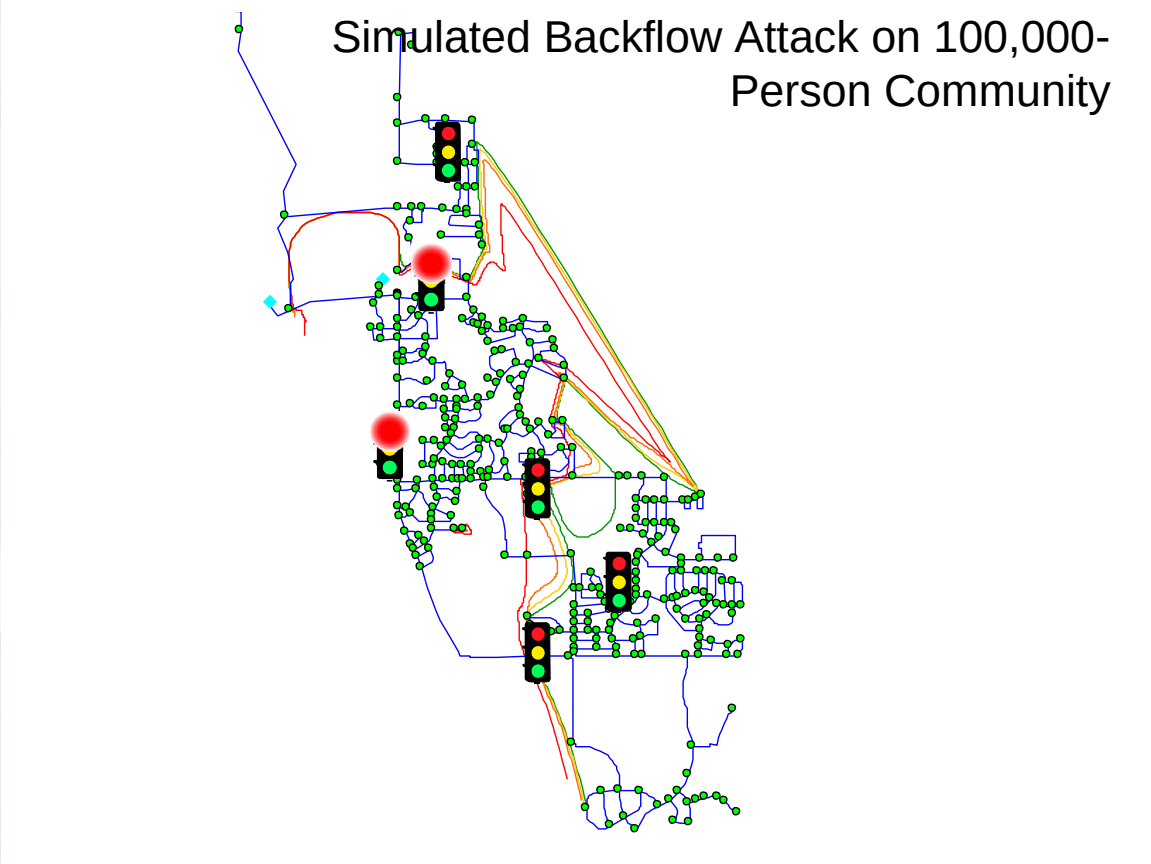
Intrusion 11:00 hours



Intrusion 12:00 hours



Backflow Attack Wave front



Results Predicted:
In a city of 100,000: Entire Populations Hit with Poisonous Water within 12 hours. 12% of Population Dead within 48 hours with a 1080 attack; 22% dead with VX attack.

1980 Chlordane Incident

- Purposeful injection of chlordane into distribution system at an isolated valve location
- System served 10,500, of which 154 reported ill effects
- Continued contamination evident following initial purging resulted in mandated use restrictions
- Ultimately resolved by extended flushing (concentrations reduced from ~1000ug/l to 0.3 ug/l target over 3 months)
- Flushing able to restore usage in 1 month, but 9 months required for potable clearance
- Water heaters particularly difficult to clean

The Threat – Current Estimates

- GAO Report GAO-03-29
- Kroll (Hach HST) "Securing Our Water Supply: Protecting a Vulnerable Resource"
  - ► 22 incidents from 2000 to present
  - ► 75% of experts (32/43) identify the water distribution system as being most vulnerable (as opposed to source waters or other system components, treatment chemicals, etc.).
- AwwaRF Report
  - ► 279 Documented incidents from ~1960's to 1999
  - ► 19 deaths, 166 illnesses confirmed

US Federal Reports on the Backflow Threat:

US Air Force, *"A Chemical and Biological Warfare Threat---USAF Water Systems at Risk",* 1999.

GAO, *"Experts Views on How federal Funding Can Best Be Spent to Improve Security",* 2003.

White House/OSTP, *"The Physical Protection of Critical Infrastructures and Key Assets",* 2003.

National Research Council, *"Making the Nation Safer",* 2002

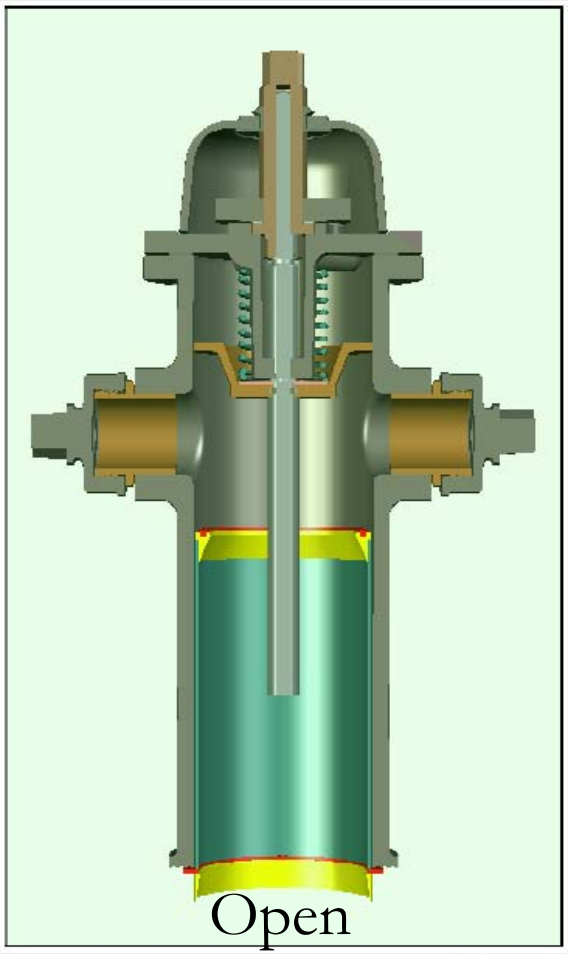
Council of Foreign Relations, *"America Unprepared---America Still in Danger*", 2002.

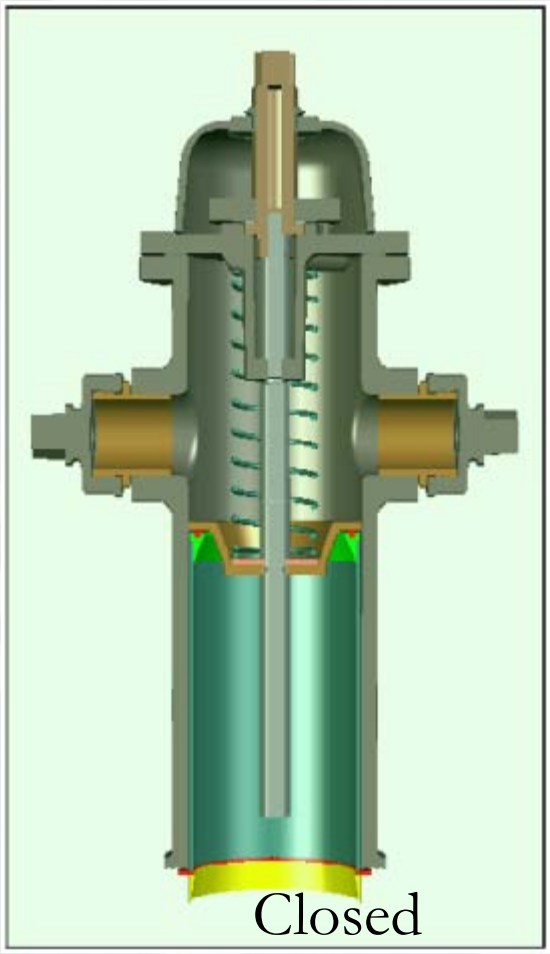
THE THREAT-GAO EXPERTS

- According to report by the General Accounting Office released in 2004
- The *distribution system* is the top vulnerability of drinking water systems with *hydrants* specifically referenced
- "…the distribution of a chemical, biological or radiological agent via the distribution system could be difficult to detect until it is *too late* to reverse any harm done."

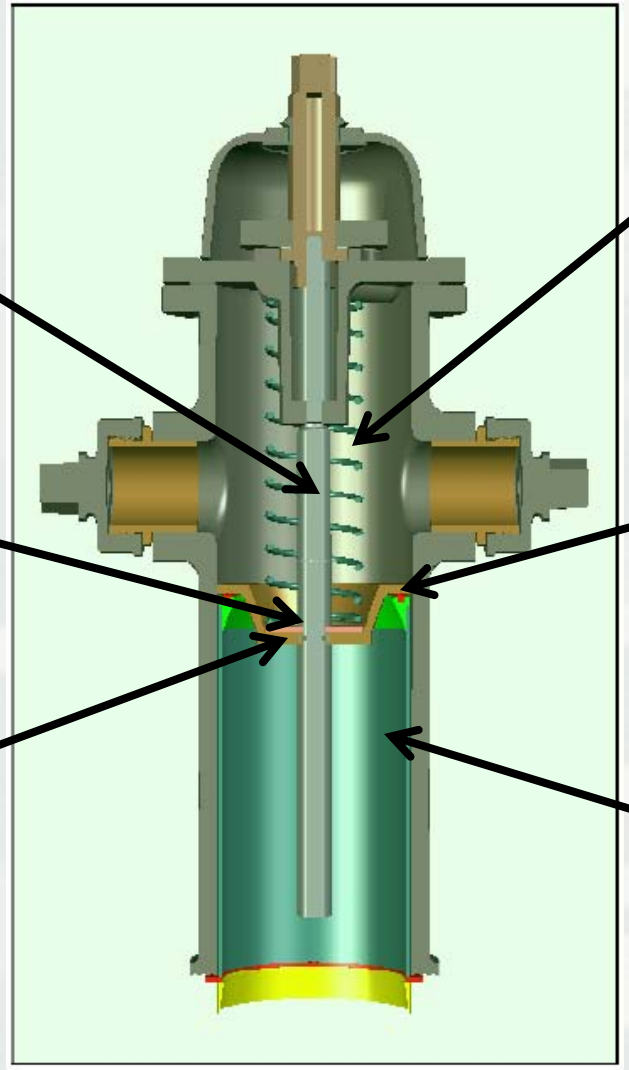
Is this scene familiar?

Antiterrorism Retrofit Valve Internal to Hydrant Barrel





Features



304 Stainless Replacement Stem, Tensile Strength 80 Ksi

302 Stainless Steel Spring

Viton O-Ring for Valve/Stem Seat

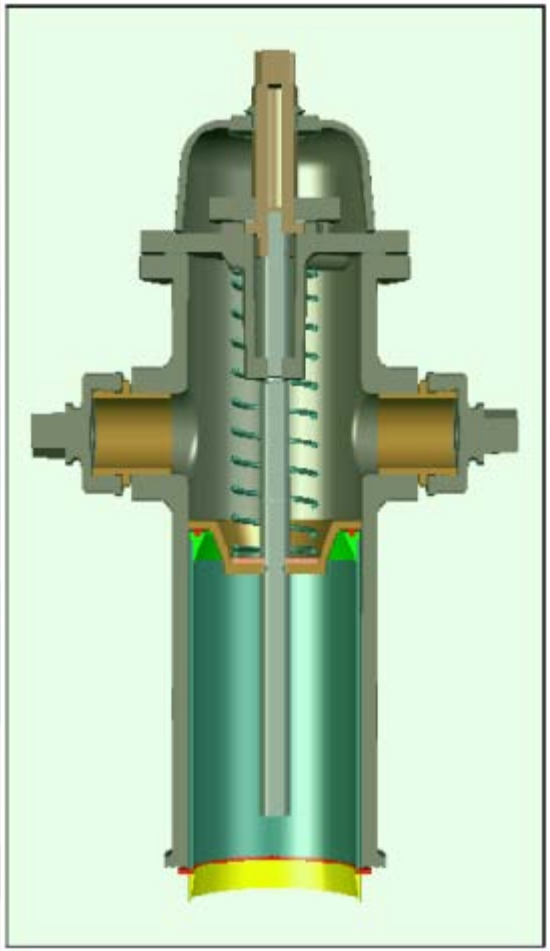
Viton Quad Ring for Valve Seat

Brass Valve Body, Cast From C84400 Bronze

E Coated Sleeve/Seat 11 ga, A-569 Hot Rolled Steel

Features

- Meets AWWA C502 Specs
- Offers continuous protection
- Easily retrofitted into new or existing hydrants
- Stealth design
- Fire Fighters operate hydrant as usual
- Ten year warranty
- Extremely durable materials for long life
- Qualifies for funding from several sources



AWWA Performance Tests of a Muller Super Centurion 250 Fire Hydrant with a Davidson ATV Security Device

Written By: William Rahmeyer PhD P.E.

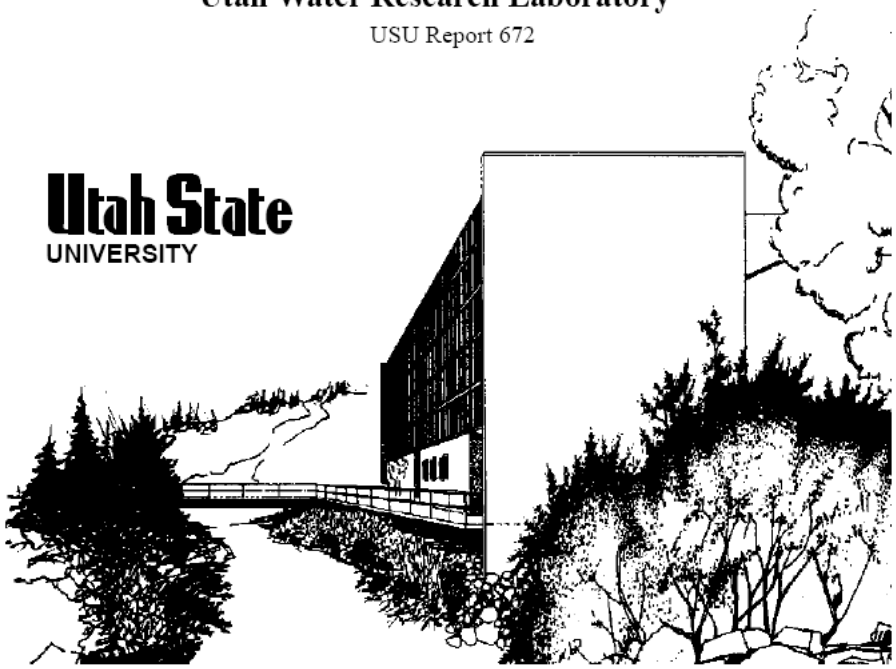
Professor of Engineering, Utah State University

October 2006

prepared for
Davidson Hydrant Technology Inc.
Peachtree City, GA.

Utah Water Research Laboratory

USU Report 672



OKLAHOMA AVENUE
TRAYER ROAD
PINEY HILLS DRIVE
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4000-11
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4000-102
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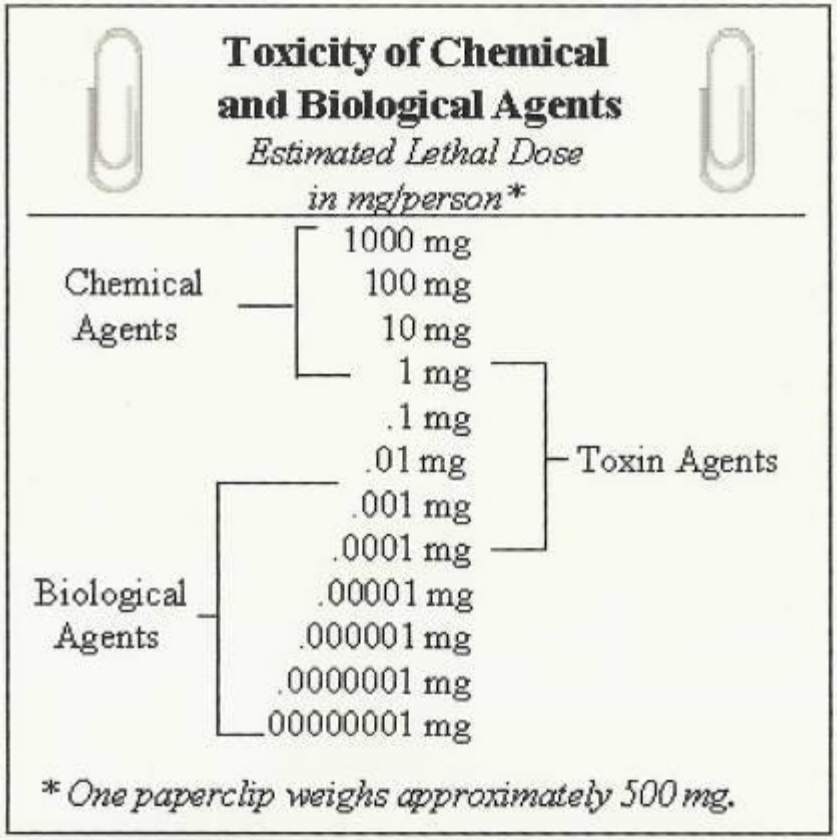
Conclusions:

- The Corrosion Program Demonstrations at 2 Army installations are testing an Integrated Water Security Program Dedicated to:
- (1) Corrosion of Infrastructure: Pipes + Hydrants
- (2) Protection of Soldiers and Their Families from Water Related Terrorist Attacks

BACKUP SLIDES

Toxicity of Chemical & Biological Agents



Source: Office of Technology Assessment, *Technologies Underlying Weapons of Mass Destruction* (Washington, D.C.: U.S. Government Printing Office, December 1993), p. 77.

The Threat, CONTINUED

- Injecting agents into drinking water via fire hydrant
  - ►Filling hydrant with agent and siphoning into main
  - ►Pumping into hydrant using truck or other tank container as pump